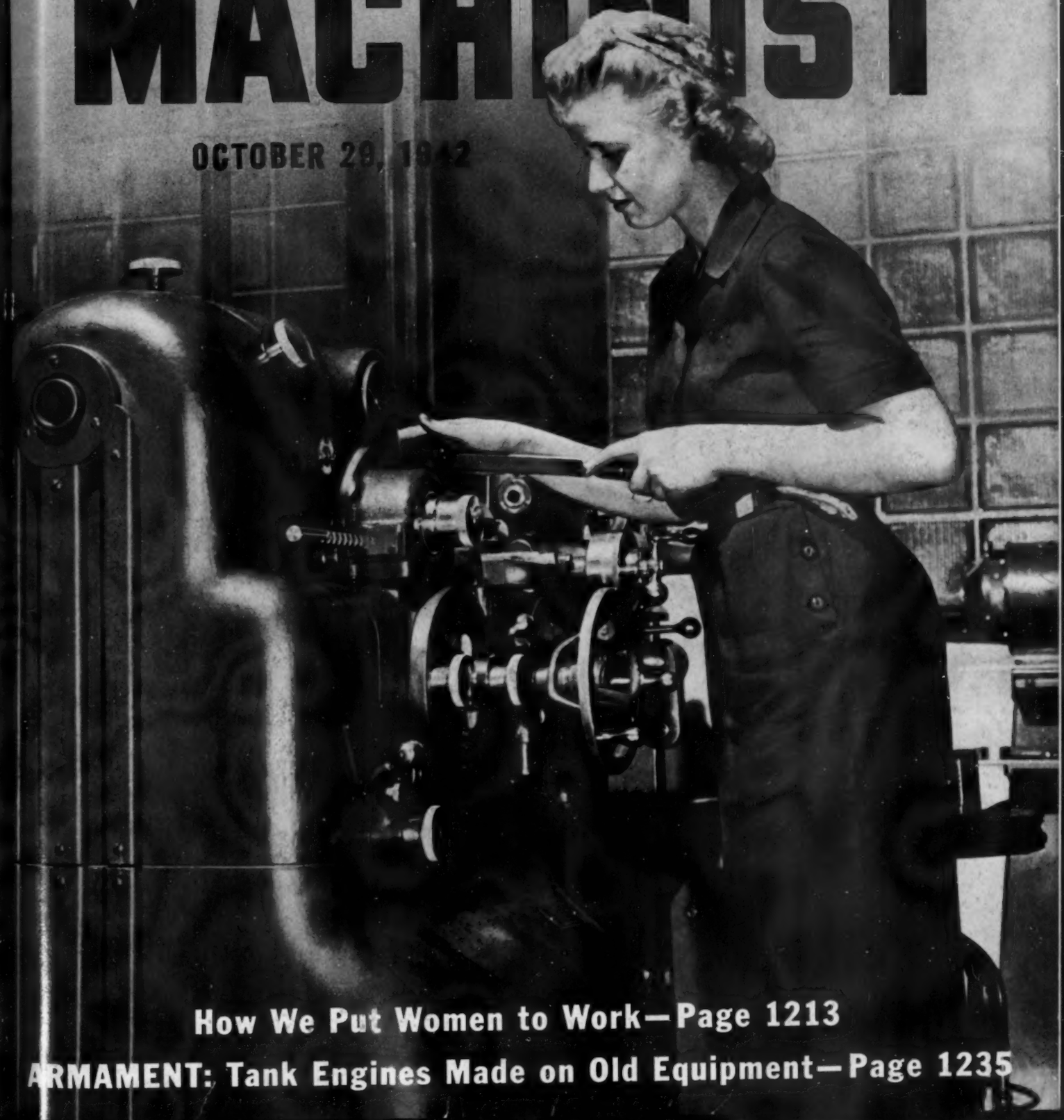
AMERICAN MACHINIST

OCTOBER 29, 1942



How We Put Women to Work—Page 1213

ARMAMENT: Tank Engines Made on Old Equipment—Page 1235

Your Engineering Branch in Worcester

HEALD FACTORY SERVICE

2. Production will beat the Axis — but we've got to work fast. Every minute counts, and all those non-productive minutes spent on production problems add up to hours irretrievably lost. Valuable time could be saved by a staff of experts capable of solving machining problems quickly. Such men are scarce but nevertheless are available, *immediately*, if your problem involves precision boring and grinding — thru *Heald Factory Service*. This service provides both the engineers and the know-how needed to get stalled jobs rolling. To get Heald Factory Service Engineers on the job simply give us your problem with complete details. Chances are their specialized knowledge of every phase of precision finishing will produce a speedy solution. Useful, too, are quick delivery of repair parts provided by Heald Factory Service, the Heald school for training your men to operate Heald machines, the parts catalogs and instruction manuals available. All in all, this gives you an invaluable engineering branch in Worcester — worth using, worth consulting. Let's have your problem — write, phone or wire us today.

BORIZING ENGINEERING DEPARTMENT
Here are a few of our 250 engineers ready to tackle your problem.

Heald 3 POINT SERVICE
Keeps Production Rolling

1. Field Engineering Service
2. Factory Engineering Service
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THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A.
MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AMERICAN MACHINIST

October 29, 1942

Woman Worker—Industry is finding that many of the jobs in a plant can be performed by women if necessary

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A COURSE
IN
MODERN METAL-WORKING

★

● Practically every Metal-Working production man is "going to school" as he works at his job of increasing America's armed might.

Even the most experienced executives have had to learn new lessons as they turned from peacetime manufacture to the new and often difficult requirements of armament production.

And oldsters and youngsters alike have to keep on their toes to stay abreast of the daily developments in Metal-Working techniques. Developments that point to many lasting trends in post-war practice.

To keep feeding this great hunger for know-how, *American Machinist* editors—in collaboration with the industry's leading executives and with Army and Navy munitions experts—are constantly digging for every bit of information that will prove helpful.

Witness the every-issue Armament Sections . . . Working of Materials Sections . . . major articles on many subjects, including the urgent one of supervisor and worker training . . . Ideas From Practical Men . . . Shop Equipment News . . . Etc. . . . Etc. . . .

In step with this editorial service, witness the increasing helpfulness of the advertising in *American Machinist*. The firms to whom you look for the newest and best in products are genuinely trying to give you information that will speed the war effort.

Add up this editorial and advertising service. Weigh its solid, fact-filled content. It's easy to see why more and more Metal-Working management and production executives are *studying* each issue, from cover to cover, as never before. They realize its value—to them and their employees—as an education in up-to-date methods.

And all of this comes to you fortnightly as part of your regular

AMERICAN MACHINIST

SPEED AND PRECISION

OFFICIAL U. S. NAVY PHOTOGRAPH

START HERE

GRINDING A SPIRAL BEVEL AIRCRAFT PINION ON A NO. 17 HYPOID GRINDER

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

ARMY E NAVY

Treat your cutters

Milling
WITH
HIGH SPEED STEEL
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI, OHIO
NNATI MILLING MACHINE CO.
OUNTING OF CUTTERS
of success of various milling jobs is de-
vance of certain principles of set-up which
good milling practice. The following few
discussion of these principles as related to
been accurately sharpened will have all of
ht, a definite requisite for quality finish and
accuracy must be preserved when mounting
g cutters that are to be mounted on arbors,
arbor itself run true and that it is of the
to the hole in the cutter. The taper shank
free from nicks and burrs and must seat
nose of the machine. The ever-present
also plays a vital part in the accuracy of
slightest particle of dirt between the arbor
nose may cause the arbor and cutter to run
CUTTER
ARBOR COLLAR
Figure 8
Mounting a Thin Slotting Cutter on an Arbor
10

CINCINNATI

Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

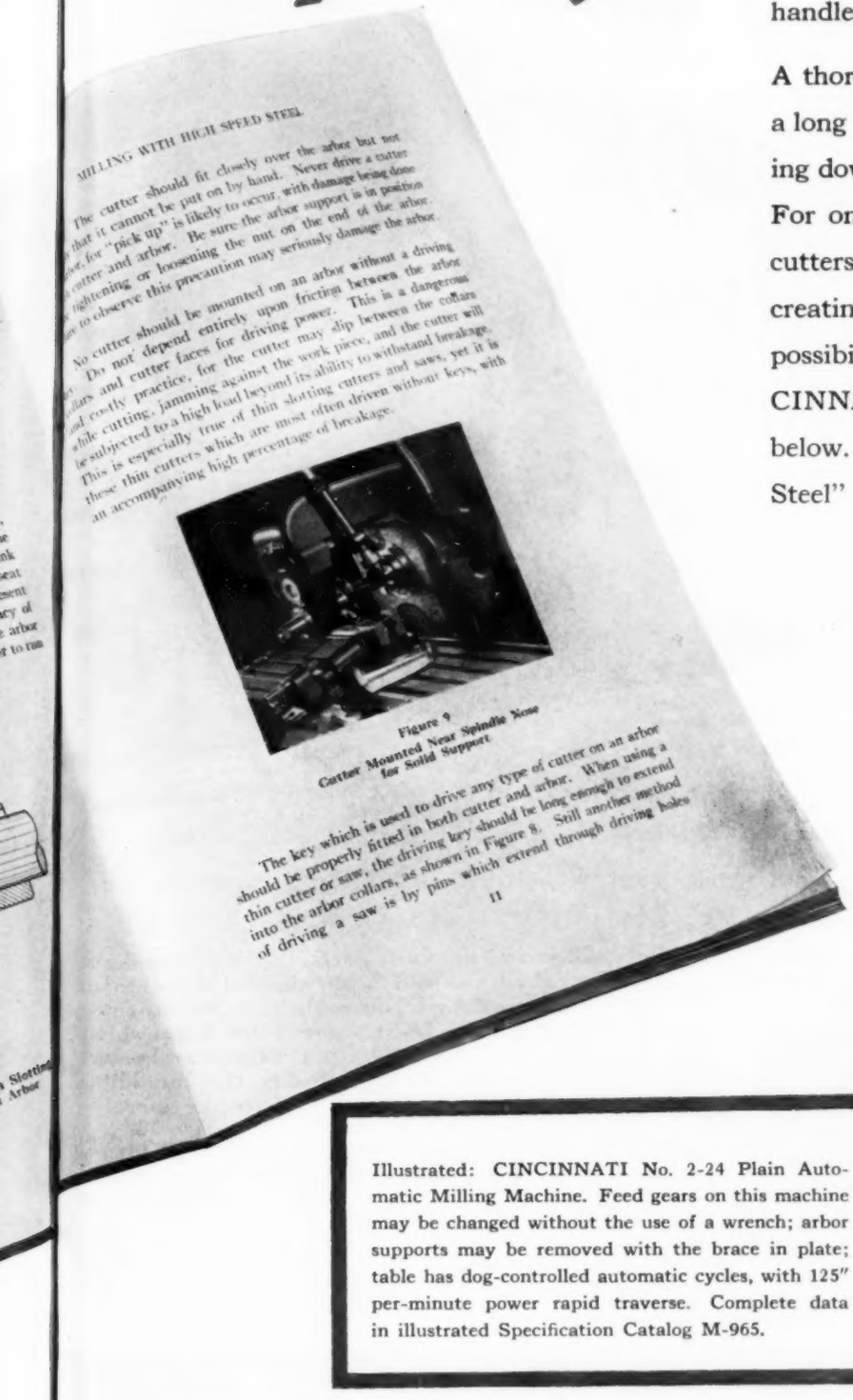
THE CINCINNATI M

TOOL ROOM AND MANUFACTURING MILLIN

right!

The useful life of Standard High Speed Steel milling cutters depends upon how they are handled, sharpened and used.

A thorough understanding of these cutters goes a long way toward increasing production, reducing down time, and lowering maintenance costs. For one thing, it reduces the number of times cutters must be changed on long jobs, thus creating an opportunity to use the production possibilities of bed-type millers, like the CINCINNATI No. 2-24 Plain Automatic shown below. A copy of "Milling With High Speed Steel" will be sent on request. Write today.



MILLING WITH HIGH SPEED STEEL

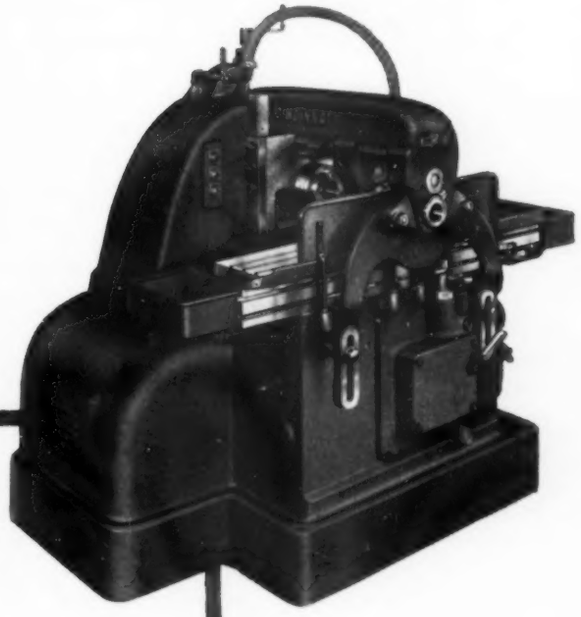
The cutter should fit closely over the arbor but not that it cannot be put on by hand. Never drive a cutter ver, for "pick up" is likely to occur, with damage being done cutter and arbor. Be sure the arbor support is in position tightening or loosening the nut on the end of the arbor. re to observe this precaution may seriously damage the arbor.

No cutter should be mounted on an arbor without a driving . Do not depend entirely upon friction between the arbor llars and cutter faces for driving power. This is a dangerous d costly practice, for the cutter may slip between the collars hile cutting, jamming against the work piece, and the cutter will e subjected to a high load beyond its ability to withstand breakage. This is especially true of thin slotting cutters and saws, yet it is these thin cutters which are most often driven without keys, with an accompanying high percentage of breakage.

Figure 9
Cutter Mounted Near Spindle Nose for Solid Support

The key which is used to drive any type of cutter on an arbor should be properly fitted in both cutter and arbor. When using a thin cutter or saw, the driving key should be long enough to extend into the arbor collars, as shown in Figure 9. Still another method of driving a saw is by pins which extend through driving holes

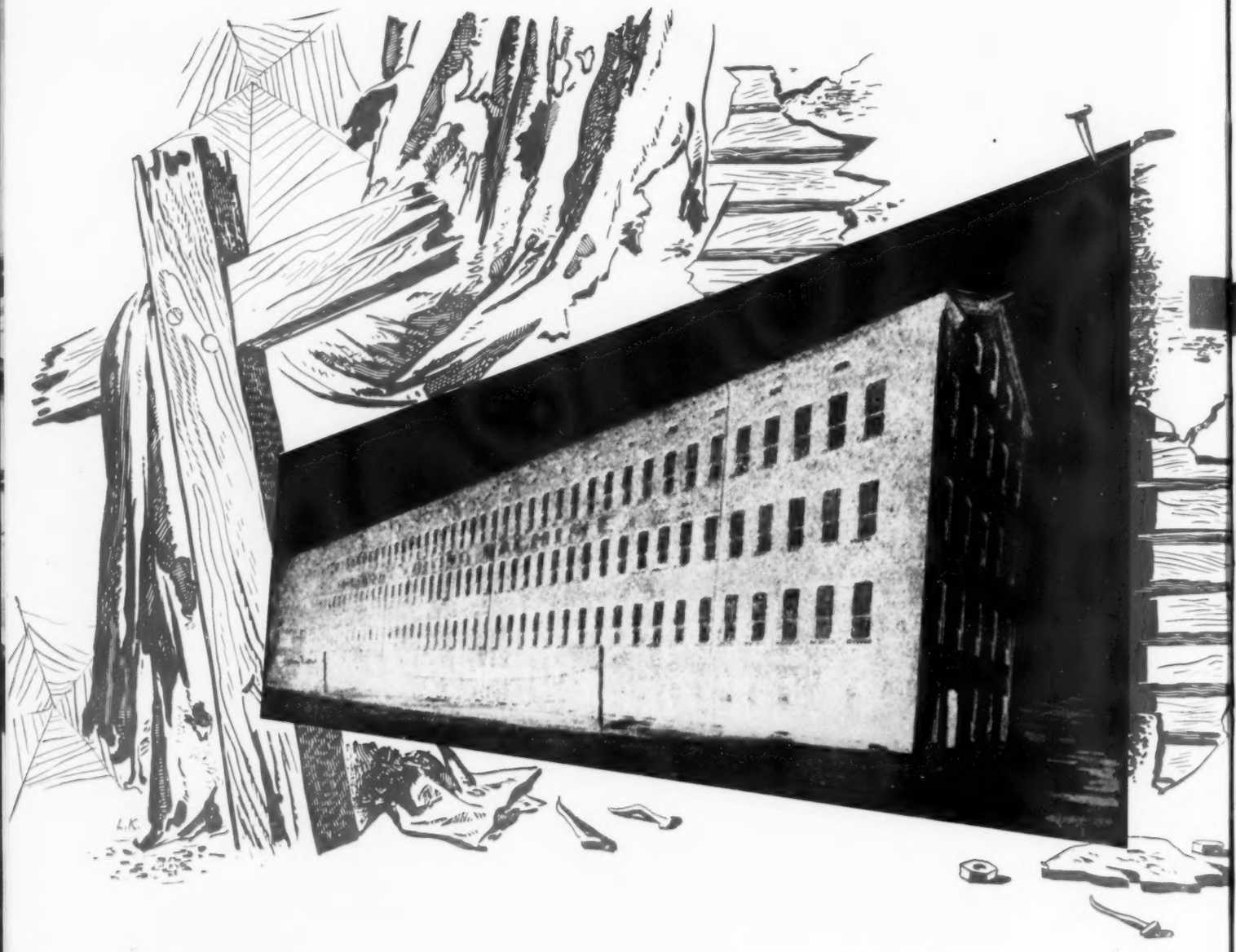
11



Illustrated: CINCINNATI No. 2-24 Plain Automatic Milling Machine. Feed gears on this machine may be changed without the use of a wrench; arbor supports may be removed with the brace in plate; table has dog-controlled automatic cycles, with 125" per-minute power rapid traverse. Complete data in illustrated Specification Catalog M-965.

TI MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

ING MILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

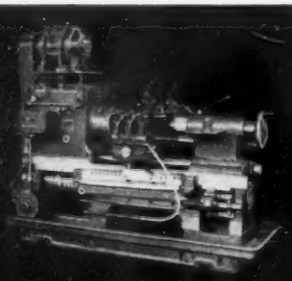


Not by the shades of people is this bemused old bastille haunted. Built a century ago—looming rather small now, in the midst of acres of modern plants—it claims the oddest assortment of industrial ghosts that ever haunted a hall.

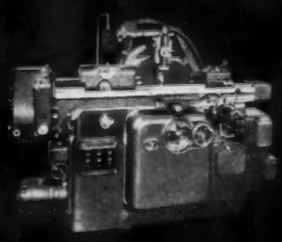
The building is in New England, and its "ghosts" are the things that have been made within its walls—things that span the entire history of manufacturing.

It is haunted by the first machine tools that were made there, when men still believed in witchcraft. Then muskets, rifles, and machine parts, in the pre-gaslight era. . . . The shades of old high wheeled bicycles, of the pantaloon period, pedal down its halls, and antique sewing machines were built there when hoop skirts were in vogue. Then came strange cylinders and valves—and terrible sounds—and one day the incredible horseless carriage rolled through its barnlike doors!

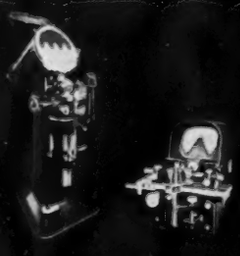
Finished? Done? Far otherwise. Today, 2,000-horsepower airplane engine parts are made in this proud old plant with its memories of muskets, its century of ceaseless change.



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

THE CASE

OF THE HAUNTED FACTORY

THE products of this fabulous factory are far more revealing than words in telling of one of America's oldest machine tool companies, for here is a curious fact:

Machine tools built by the early founders of Jones & Lamson were the first things to be made there . . . and machine tools built by successive Jones & Lamson generations have helped to keep that plant steadily producing through its century of manufacturing progress.

And that is the story, too, of many of America's most famous plants. For Jones & Lamson has literally grown up with America's industries.

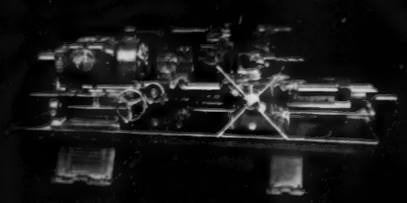
Today, such a background of inherited knowledge and facilities is important. It means that Jones & Lamson engineers and service men are uniquely qualified to serve any phase of industry . . . right now, and during the difficult period of post-war readjustment.

JONES & LAMSON MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

SPRINGFIELD
VERMONT, U.S.A.

PROFIT PRODUCING
MACHINE TOOLS



SADDLE TYPE
UNIVERSAL TURRET LATHE

RAM TYPE
UNIVERSAL TURRET LATHE

WAR PRODUCTION BULLETIN

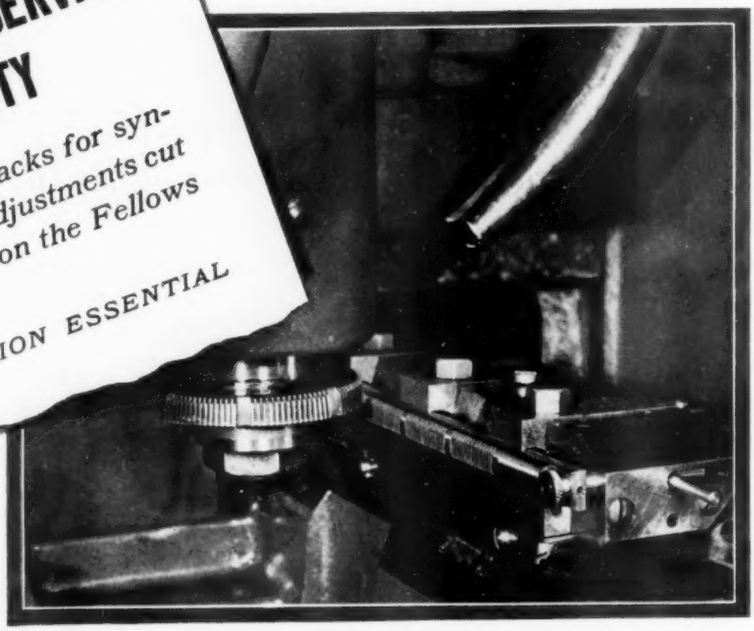
DIESEL ENGINE PARTS MADE FOR WAR-SERVICE RELIABILITY

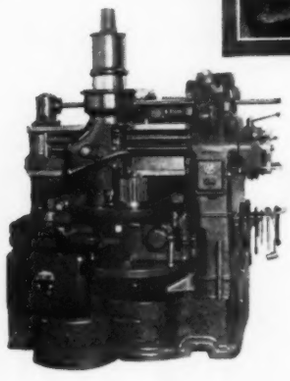
Interrupted tooth racks for synchronized valve adjustments cut in one operation on the Fellows Gear Shaper.

HIGH PRECISION ESSENTIAL

THE Versatile

FOR





FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

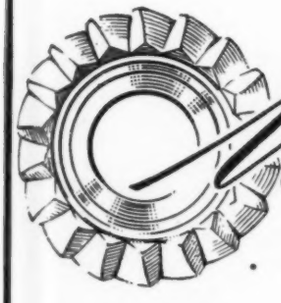
GEAR SHAPER

PRECISION DUPLICATION OF

- GEARS
- SPLINES
- SEGMENTS
- RATCHET TEETH
- CAMS
- IRREGULAR SHAPES
- SPROCKETS
- RACKS
- INTERRUPTED PROFILES
- IRREGULAR CONTOURS

Fellows Cutters are made to generate many shapes in addition to involute gear teeth. They can be form-ground to a large variety of contours, and thus can be applied to the production of a multitude of irregular shapes.

Since the accuracy of Fellows Cutters is duplicated on the work, the Fellows Method stands pre-eminent in the field of interchangeable parts manufacture. The standard Gear Shaper using standard and special cutters, fixtures and work-holding outfits is being used on a large variety of war work. Fellows Gear Shapers and Gear Shaper Cutters will handle those unusual jobs which you need produced accurately and in large quantities. Let us counsel with you on the tooling for those unusual operations.



Method

. . . . FROM BLANK TO FINISHED GEAR

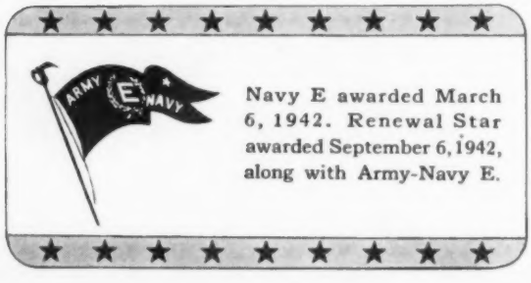
Better Grinding

CINCINNATI

THROUGH GREATER KNOWLEDGE

If every grinding production man had a copy of "Precision Cylindrical Grinding" at his fingertips, the country's war production program would be benefited.

This little booklet — another communique from grinding headquarters — tells of the uses and performance limits of both Centertype and Centerless Grinding Machines — valuable information for any man with a grinding problem. Causes of trouble, such as chatter, scratches on work, and work ground hollow in the center, are described with their remedies. A copy of this informative booklet, "Precision Cylindrical Grinding," is yours for the asking.



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

CINCINNATI

CENTER TYPE GRINDING MACHINES

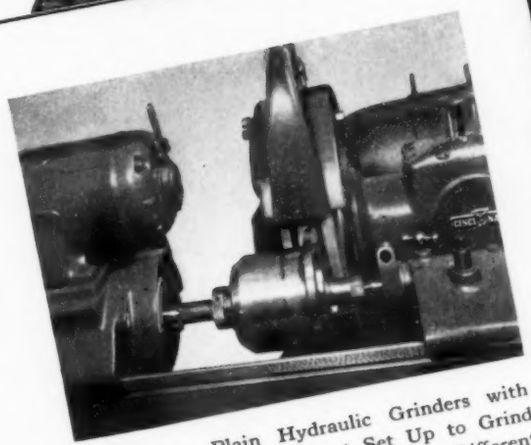


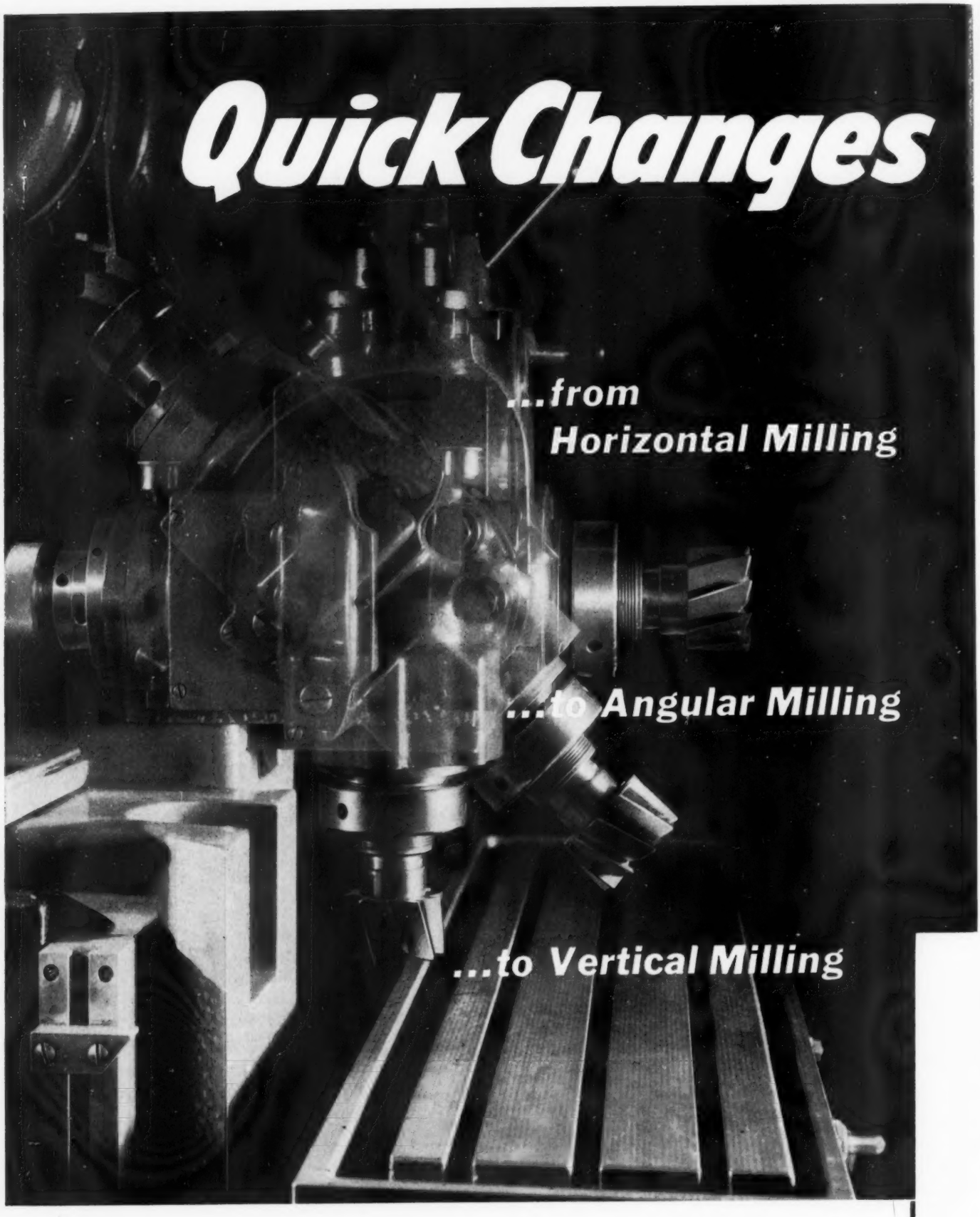
Figure 2 — Plain Hydraulic Grinders with Triplex-Wheel Arrangement Set Up to Grind Fixed Cams — Finish Grinds Three Different Diameters Simultaneously.

Figure 12 — Centerless Grinding a Steering Knuckle by a Special In-Feed Arrangement.

GRINDERS INCORPORATED

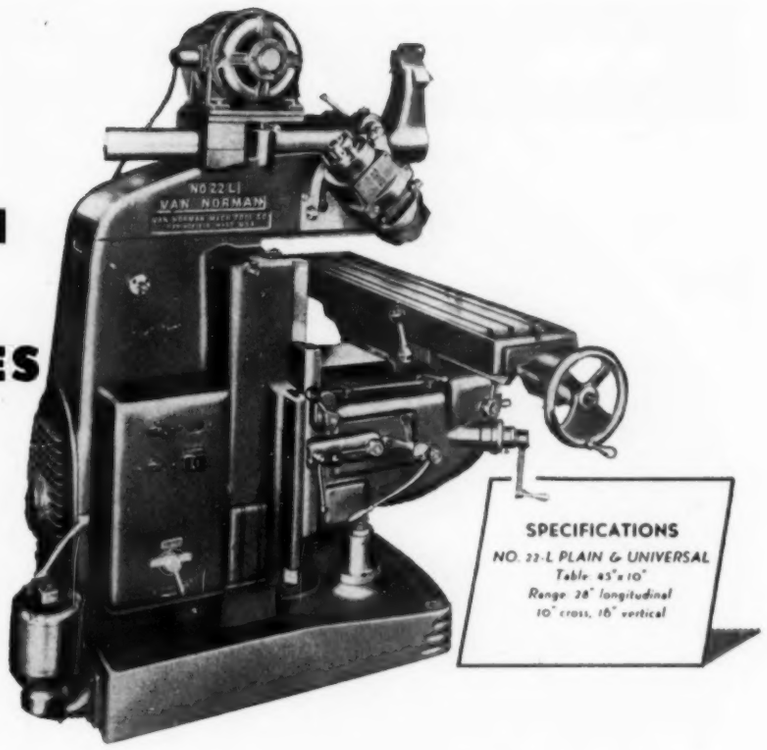
CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



VAN NORMAN MACHINE TOOL COMPANY

ON VAN NORMAN RAM-TYPE MILLING MACHINES



When the operator has completed a horizontal cut on a Van Norman Ram-Type Miller, and wishes to proceed to an angular or vertical cut . . . *he does not need to touch the set-up on the table.* All he has to do is unclamp the swiveling cutterhead, swing it to the required position, reclamp . . . *and start the next cut.* Only a matter of moments, compared with the time needed to reset the work. And one of the greatest sources of errors is completely avoided. This exceptional ease and convenience of operation provide gains in time, accuracy and output. So today, throughout America's war industries, Van Norman Ram-Type Millers are delivering the goods in great plenty . . . and in plenty of time.

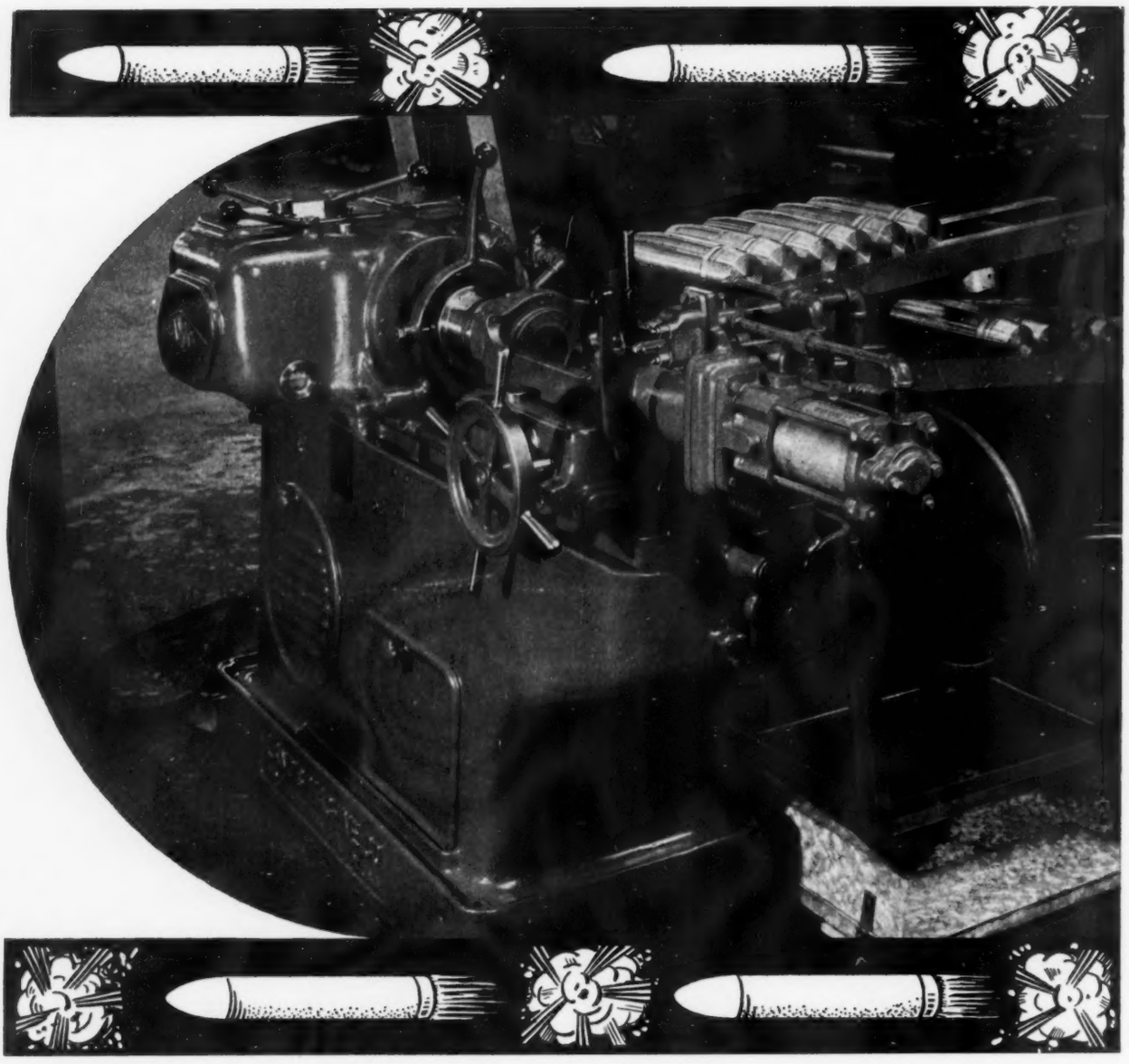
Van Norman

MILLING MACHINES

ARMY E NAVY

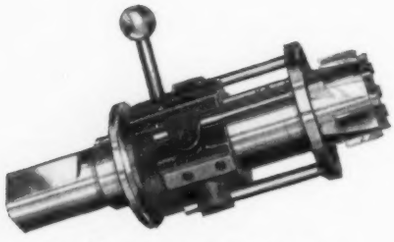
In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

SPRINGFIELD, MASS.



These Landis Machines Are

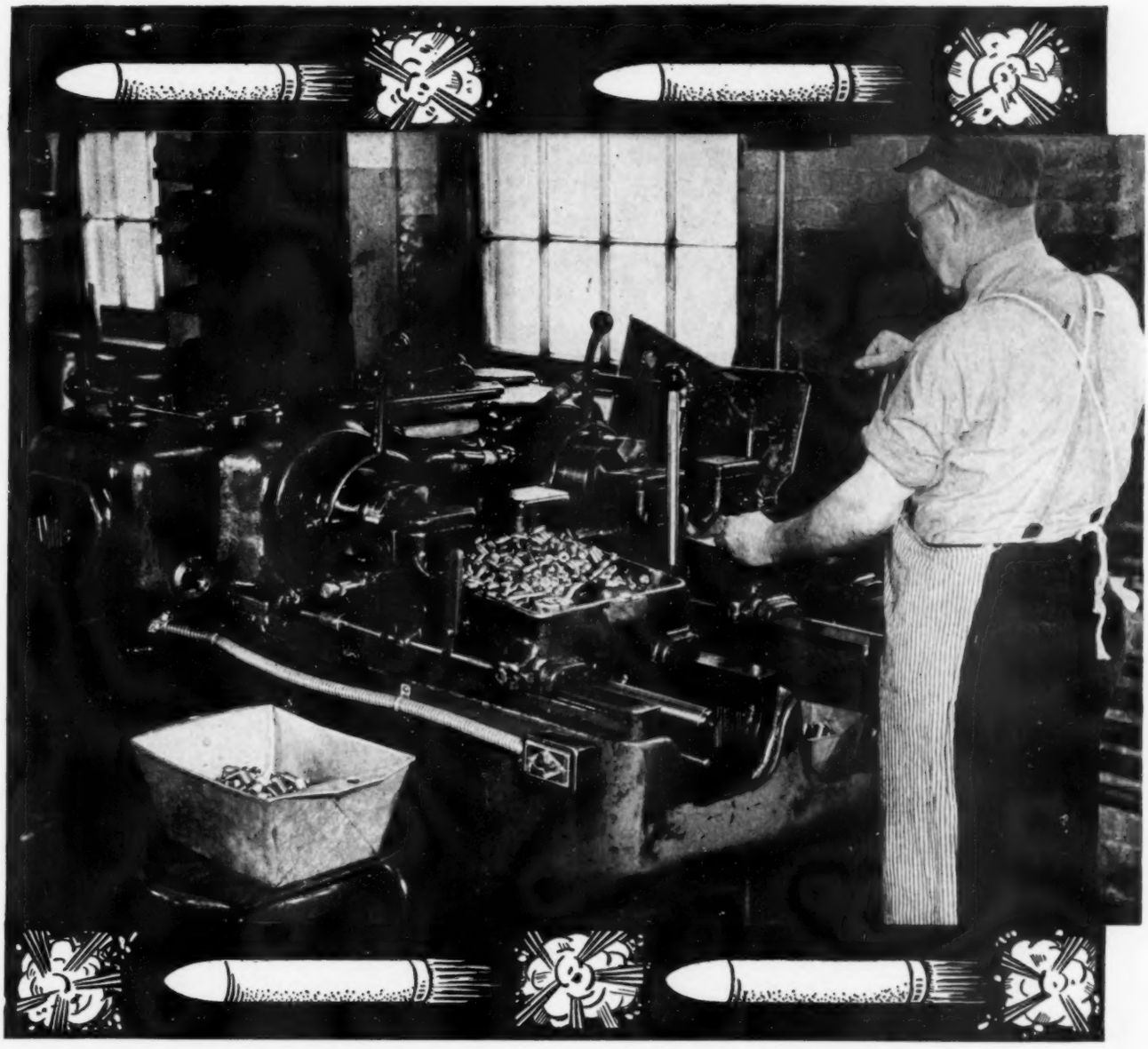
LANDMACO *Shell Tappers*



LANDIS Style LT Collapsible Tap

In hundreds of munitions plants throughout the country LANDMACO Shell Tappers have set new production standards for precision threading operations. Manufacturers write us LANDMACO Tappers are also saving many labor hours and lowering operation costs.

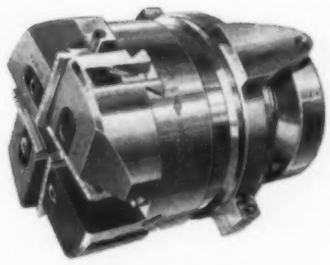
LANDIS MACHINE COMPANY



Setting War Production Records

LANDMACO *Threading Machines*

In shipyards, aircraft plants and armament factories LANDMACO Threading Machines are speeding up threading production and maintaining precision standards thought impossible. Working 24 hours a day these precisely-built machines are setting outstanding performance records.



The LANCO Head

WAYNESBORO, PENNSYLVANIA, U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

EVERY CONTROL FROM THE HEAD
and
WITHIN EASY REACH
for
QUICK OPERATION

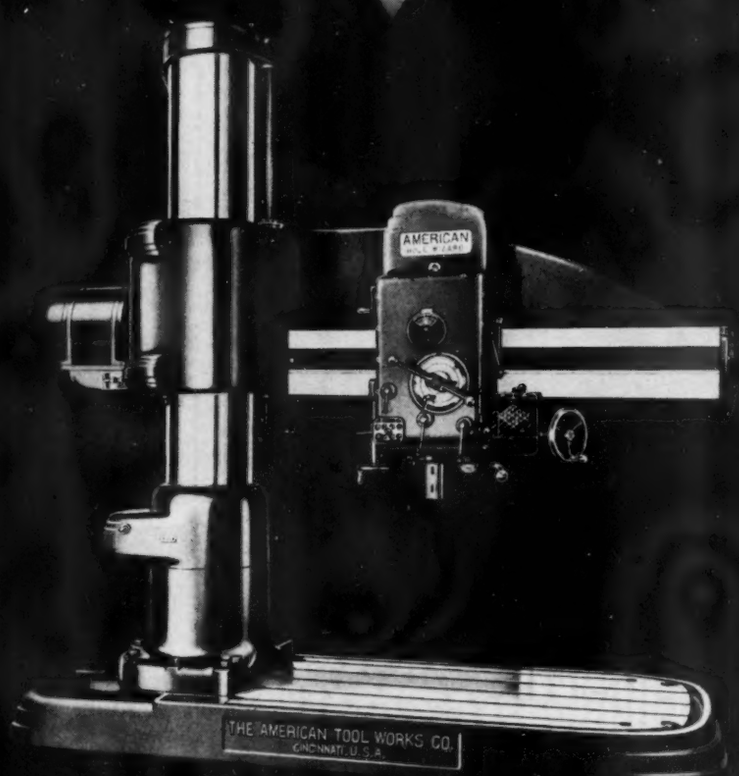
The "NEW" AMERICAN 32 SPEED HOLE WIZARD

Finger tip control is exactly what is provided on this newest of new "AMERICAN" Radials.

Not only are all controls from the head but all controls are centralized and most conveniently located within easy reach from the most natural operating position. Handling is remarkably fast and simple. Operators are amazed at the ease with which they can produce on this machine.

As a direct result of this highly developed control feature on the "AMERICAN" Hole Wizard, more holes per hour are definitely assured—and less drilling time per piece means greater returns from every pay-roll dollar.

For complete facts, see Bulletin #326. Ask for your copy.



The AMERICAN TOOL WORKS COMPANY
Cincinnati, Ohio, U.S.A.

LATHES
RADIALS
SHAPERS

Specify

HARDINGE COLLETS

FOR ACCURACY AND DURABILITY

The name HARDINGE on a collet is an accuracy and durability guarantee. When ordering collets only, or when ordering collets with lathes and milling machines of any make or size, specify HARDINGE Collets—they cost no more than other collets.

The stamping on the face of a HARDINGE Collet indicates that the finishing grinds were made after hardening the collet to assure concentricity.

Accuracy with durability comes from special steel, uniform heat treated threads, hardened surfaces for gripping or bearing, and spring temper for proper operation.

Write for HARDINGE Bulletin No. 41

Bulletin No. 41 clearly shows the styles of collets adapted in your lathes and millers. It lists the standard collets with general dimensions for identification, it gives normal round, hexagon, and square capacity of standard collets. It shows how all of your lathes and millers may be adapted for collets. Attractive prices are listed for round, hexagon and square hole sizes. It gives the location of collet stocks in Elmira, Hartford, New York, Rochester, Cleveland, Detroit, Chicago, Los Angeles, and San Francisco.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

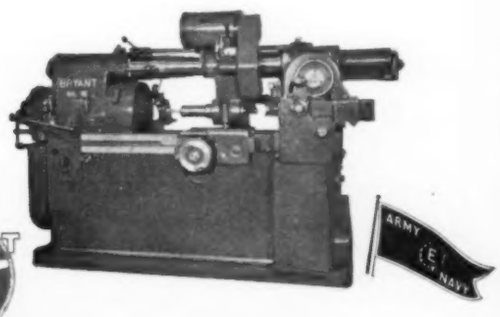
Will Victory C

ory Catch You Unprepared?

WHETHER it takes a few weeks or many months, the momentum of this war will continue to increase until it ends in victory for the free peoples. And there is every indication that the post-war world will offer rich opportunities for alert manufacturers who see ahead and make the most of the knowledge, techniques and skills developed by war production.

By designing new products, exploring new markets and planning new manufacturing economies with modern, rapid, adaptable, improved machine tools, you can make certain that victory will not take you by surprise.

Toward that end there is one step that you can take immediately: Write to Bryant. For Bryant engineers are trained and ready to study your future plans and offer you detailed recommendations on any problems involving internal grinding operations. Bryant service can help you to invade new markets and recapture old ones when peace returns.

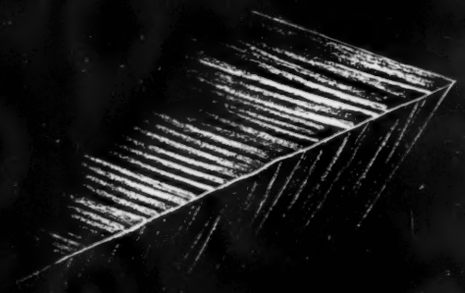


BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT, U. S. A.

Send for the Man from Bryant

Increase tool life . . . . . MANY TIMES by refined surface finishing

This cutting edge will dull quickly



This cutting edge will have long life

UNDER high magnification a cutting edge as ordinarily ground would show "hills" and "valleys" like the left-hand illustration. You can easily see that when the tool is put in use, the unsupported peaks are unequal to the load imposed upon them and quickly break off leaving flat spots that rub instead of cut. This places a greater load on the remaining edge which in turn fails quicker than it would if the edge were straight and the load equally distributed.

Norton engineers, working with prominent tool engineers, developed a method of producing the straight, even edge that means equalized loading and thus long tool life. For cutters and other multiblade tools it is a fine grain Crystolon wheel (37320-J8L or 37320-H8T-4) and for single point tools an Alundum wheel (38220-L9BE).

In many tool rooms these wheels are now producing a refined surface finish that is multiplying tool life many times—a tremendously important point today when tool steels are so scarce. A booklet "How to Increase Tool Life" gives you the complete story. Just ask for Form 986-AM.

NORTON COMPANY, WORCESTER, MASS.

New York • Chicago • Detroit • Cleveland • Philadelphia • Pittsburgh • Hartford • Hamilton, Ont.

W-895

NORTON ABRASIVES

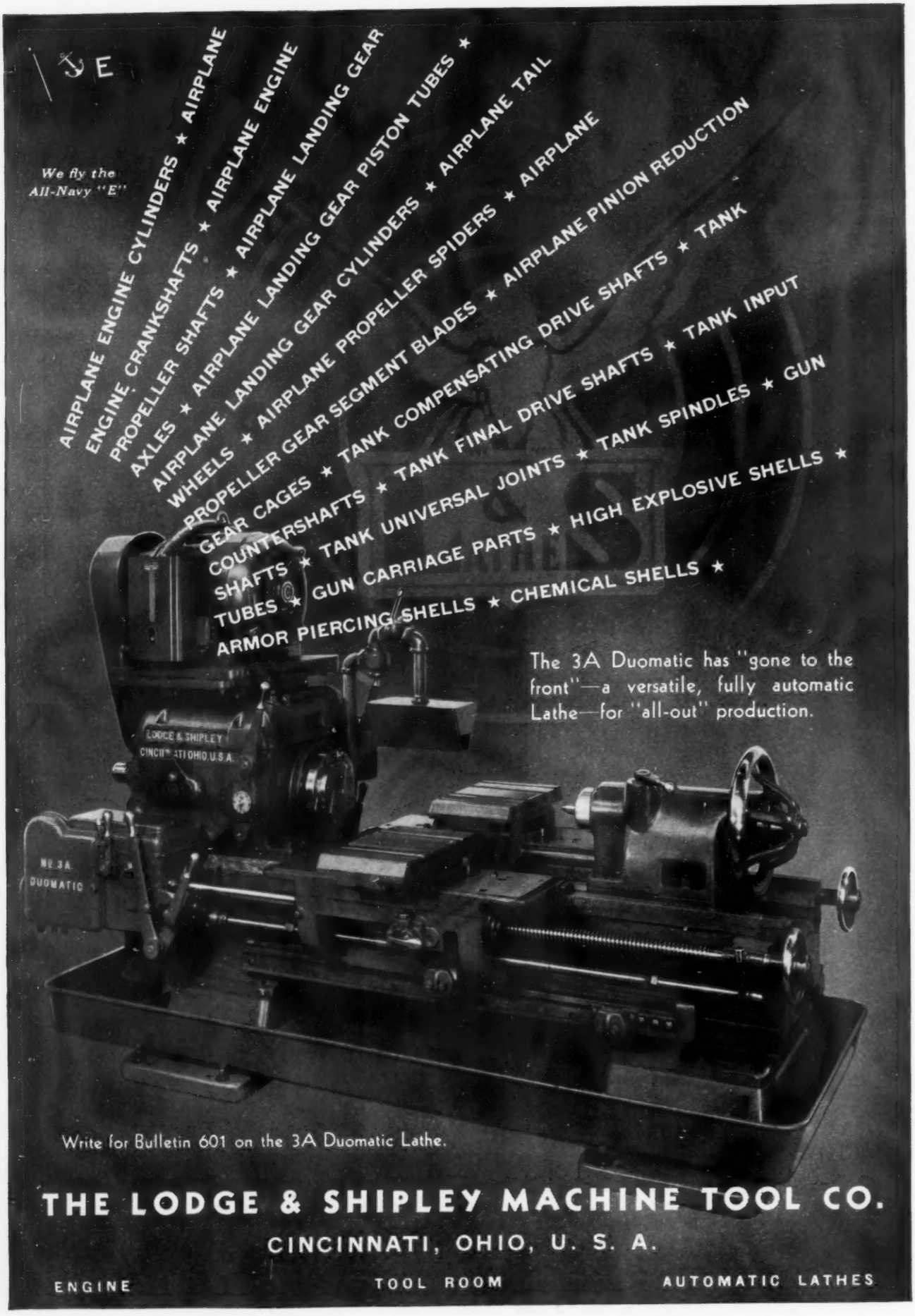
LEES-BRADNER *Model* 40 THREAD MILLER

Combines Speed and Precision for all-out WAR PRODUCTION

The Model 40 Lees-Bradner Automatic Thread Miller designed and built by the pioneers of the ring or hob type milling process for the mass production of accurate internal and external threads . . . A fully automatic machine, rugged, solid as a rock and capable of sustained quantity production . . . For dependable, precision threading at high production rates put your jobs on a Lees-Bradner Model 40.

The LEES-BRADNER *Company*

CLEVELAND, OHIO, U.S.A.


We fly the All-Navy "E"
AIRPLANE ENGINE CYLINDERS ★ AIRPLANE ENGINE CRANKSHAFTS ★ AIRPLANE ENGINE PROPELLER SHAFTS ★ AIRPLANE LANDING GEAR AXLES ★ AIRPLANE LANDING GEAR PISTON TUBES ★ AIRPLANE LANDING GEAR CYLINDERS ★ AIRPLANE TAIL WHEELS ★ AIRPLANE PROPELLER SPIDERS ★ AIRPLANE PROPELLER GEAR SEGMENT BLADES ★ AIRPLANE PINION REDUCTION GEAR CAGES ★ TANK COMPENSATING DRIVE SHAFTS ★ TANK COUNTERSHAFTS ★ TANK FINAL DRIVE SHAFTS ★ TANK INPUT SHAFTS ★ TANK UNIVERSAL JOINTS ★ TANK SPINDLES ★ GUN TUBES ★ GUN CARRIAGE PARTS ★ HIGH EXPLOSIVE SHELLS ★ ARMOR PIERCING SHELLS ★ CHEMICAL SHELLS ★
The 3A Duomatic has "gone to the front"—a versatile, fully automatic Lathe—for "all-out" production.
LODGE & SHIPLEY
CINCINNATI OHIO U.S.A.
No. 3A DUOMATIC
Write for Bulletin 601 on the 3A Duomatic Lathe.
THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U. S. A.
ENGINE
TOOL ROOM
AUTOMATIC LATHES

EFFICIENCY– Not Emergency–

Is Dictating the Swing to Bonded Lapping Stones

More and more, manufacturers of precision parts are turning to bonded abrasive lapping stones. More and more, bonded abrasive lapping stones are replacing the more conventional cast iron lapping blocks.

Instinctively, in times like these, you'll say: "It's the war and the shortage of metal." But that's not entirely true.

Bonded abrasive lapping stones have earned a place in the shop purely on their own record. Developed long before the shortage of metal became acute, abrasive lapping stones have proven their worth over and over again. Naturally, the current shortage of metal has accelerated the speed with which discerning production men have adopted this comparatively new lapping practice. But, even so, no one can ignore the fact that bonded abrasive lapping stones will:

1. **REMAIN FLAT FROM TWO TO THREE TIMES LONGER THAN CAST IRON BLOCKS.**
2. **RE-FLATTEN MUCH EASIER THAN CAST IRON BLOCKS.**
3. **ELIMINATE ALL POSSIBILITY OF CHARGING THE WORK WITH LOOSE ABRASIVE, THUS CAUSING FRICTION WHERE ULTRA-SMOOTHNESS SHOULD PREVAIL.**

Those are the principal reasons behind the switch to abrasive lapping stones. In other words, efficiency — not emergency — is dictating the change.

The Mid-West Abrasive Company has pioneered the trend toward refined honing and superfinishing of working parts. MID-WEST lapping stones, like MID-WEST honing and superfinishing stones, are made with MICRO BOND, the remarkable new abrasive developed by MID-WEST engineers that has created new standards in precision manufacturing practices.

Although MID-WEST honing, superfinishing and lapping stones cost more than average abrasives at the outset they are more economical in the long run because they last longer, perform more efficiently, leave a finer, more precise finish and result in fewer rejects. Our engineers — located in all large cities—are eager to prove these claims.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

Mid-West

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

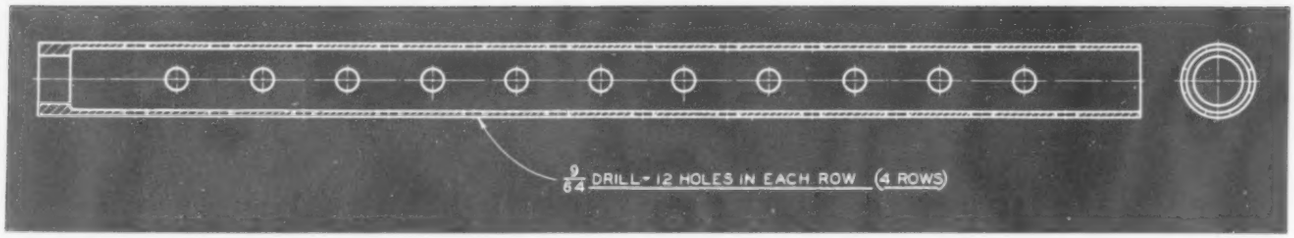
Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

*Name*_____

*Company*_____

*Address*_____

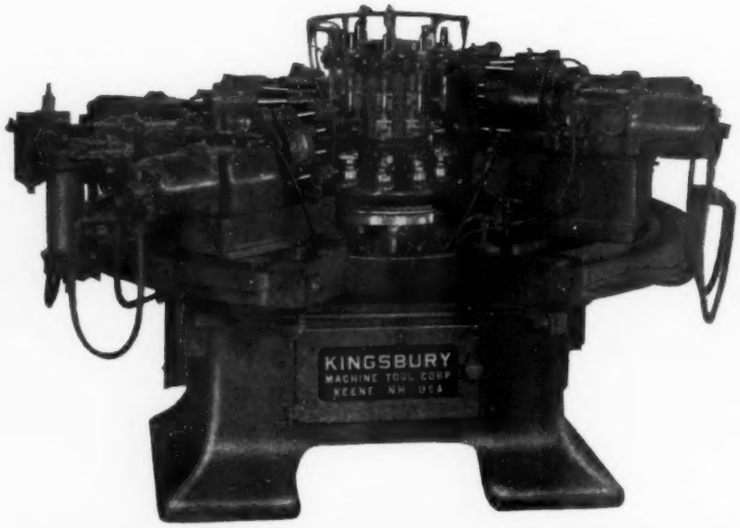


A FLEXIMATIC *by KINGSBURY*

JOB ... SPEEDING NAVAL ORDNANCE PRODUCTION!

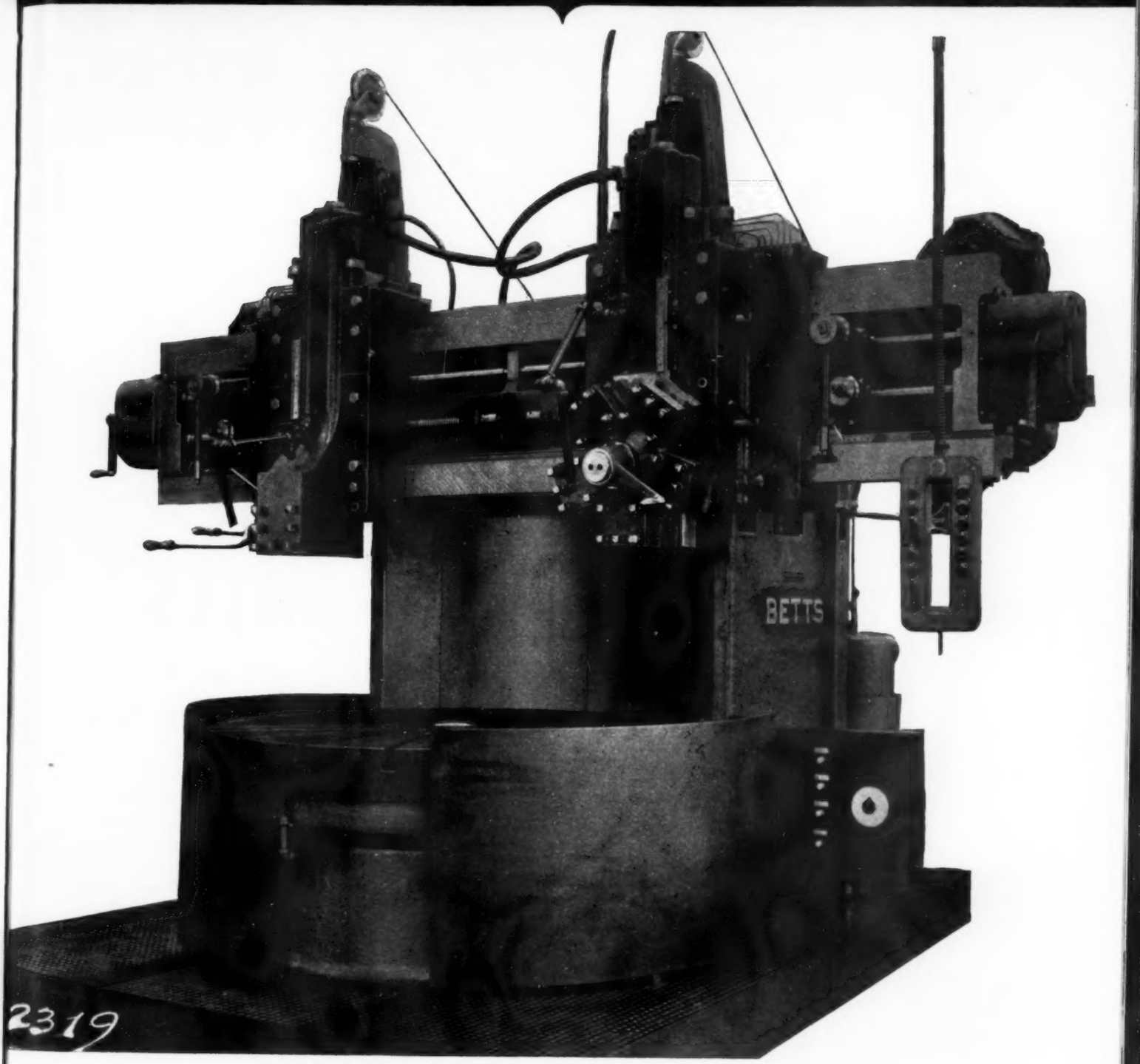
When the call came for machines capable of turning out munitions and aircraft parts at mass-production speeds, Kingsbury FLEXIMATICS were ready! Quickly made up of standard units mounted on standard bases. FLEXIMATICS can perform drilling, tapping, reaming and many other operations in **any** position or at **any** angle on **any** part that can be chucked. For example, all 48 holes are produced in the flash tube shown above in a single chucking of the work. Each work holder on the main turret is in itself a turret which indexes as the main turret indexes, thus enabling the rows of holes to be drilled at four positions on the tube without removing the work. Various lengths of tube can be handled by the machine by adjusting the position of the top clamping member.

Speeding war production by making it possible for semi-skilled labor to turn out large volumes of precision parts, Kingsbury FLEXIMATICS possess the added advantage of FLEXIBILITY that permits quick, easy changeovers to meet changes in design or machining requirements.



KINGSBURY MACHINE TOOL CORPORATION
KEENE · NEW HAMPSHIRE · U.S.A.

★ BETTS 78 -INCH TANK MILL ★



The machine shown above is known as a 78" Tank Mill. It is so named because it was planned for the mass production of parts for tanks. In designing this machine there were two principal factors involved, first—a construction which would permit building the machines on a quantity basis, thus permitting quick deliveries; and second—a construction insuring the utmost in productiveness.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

A Suggestion For Solving a War Production Problem

Thread Milling Cutters of this type are generally designated as MULTIPLE THREAD MILLS to distinguish them from similar single type thread mills. Multiple Thread Mills are used for cutting all types of screw threads and offer many advantages both in accuracy and production. For example, the Multiple Thread Mill shown here is used to cut 12-pitch threads of different diameters in three places on these tractor clutch shafts (one end of which is shown).

ITEM:

USE BARBER-COLMAN *UNGROUND* THREAD MILLS

GROUND THREAD MILLS ARE BEING UNNECESSARILY ORDERED IN MANY CASES

Check your specifications! In many cases, such as screw fastenings, bolt ends, and the like, where there is no problem of leakage, or for shells, fuses and bombs, it is unnecessary to order ground thread mills. Manufacturing facilities for ground thread mills are overloaded — capacity for making UNGROUND Thread Mills *is available*. Furthermore, Barber-Colman is now able to offer *Unground* Thread Mills, which, in 75% of manufacture, will produce work within the tolerances of Class III specifications! This is due to recent Barber-Colman research and progress in heat treatment, and is limited to cutters of 1" face or less. If you are in doubt about a particular job, call for our engineering consultation service.

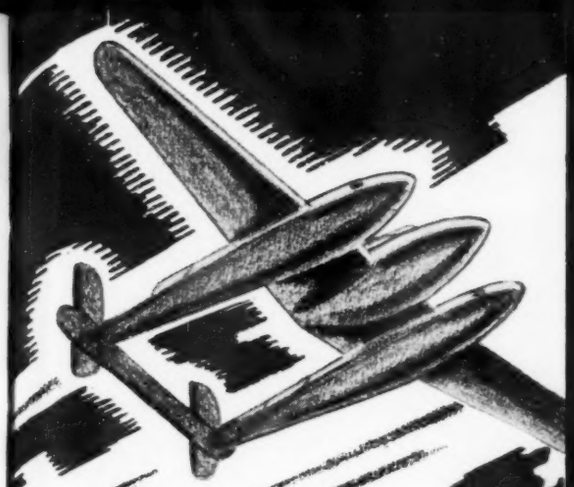
ON THIS JOB, FOR INSTANCE . . .

Here is a case where Ground Thread Mills were formerly used and have now been replaced with Barber-Colman Unground Thread Mills, still maintaining the tolerances. The piece is a tractor clutch shaft with 12-pitch threads in three places (only one of which is shown). The cutter is run at 220 r.p.m. and production on the 1¼" dia. thread shown is 20 pieces per hour average including inspection at the machine. Accuracy on the major diameter and pitch diameter is .002" and accuracy on the lineal pitch is .0005". The cutter is 2½" dia. by 1" face and gives 240 pieces per sharpening.

BARBER B-C COLMAN PRODUCTS
MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

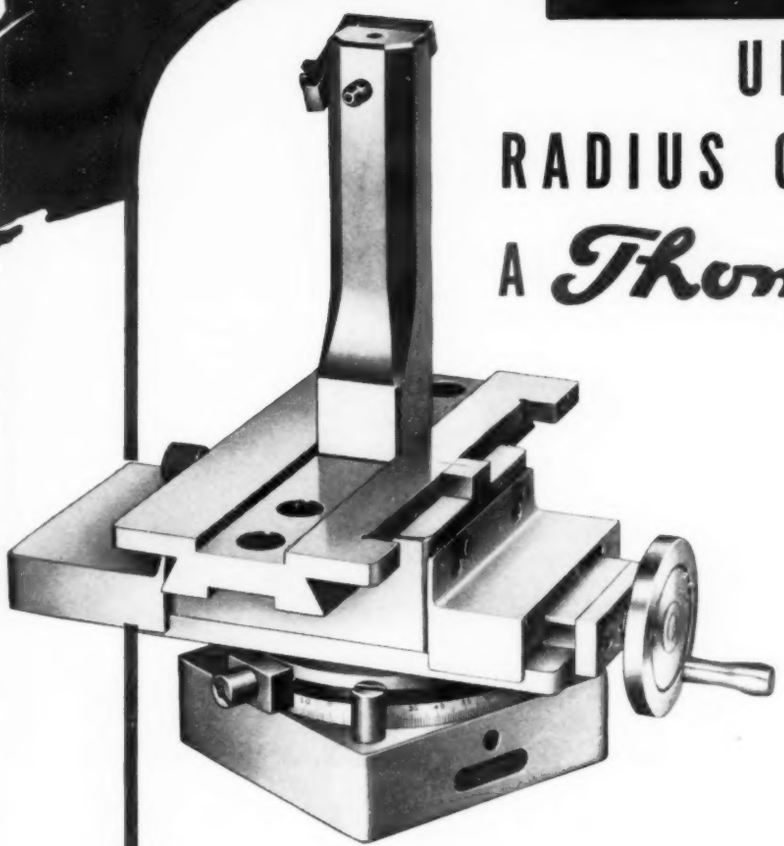
General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.



A FLEXIBLE NEW TOOL TO SPEED *Vital* PRODUCTION

UNIVERSAL RADIUS GRINDING DRESSER

A *Thompson* · PRODUCT



PATENT PENDING

This Dresser will dress a radius on a wheel either concave or convex from 30 thousandths to 4 inches and do same accurately and efficiently.

The Dresser is set by gauge blocks eliminating any guess work.

It will also dress any angles required on a wheel.

Also can be set for a radius and angle without changing the set up.

TRADE MARK
Thompson
REG. U.S. PAT. OFF.

AUTO-ORDNANCE *Corporation*

THOMPSON TOOL DIVISION

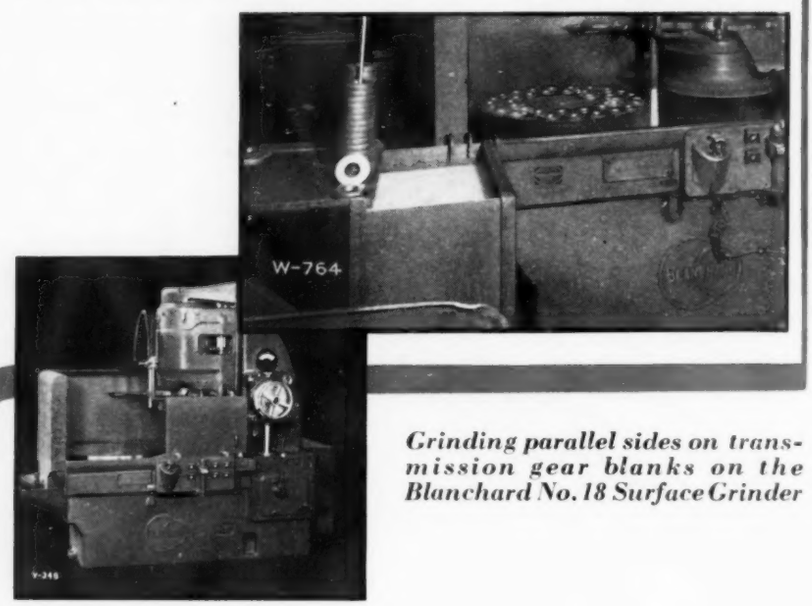
42 WEST PUTNAM AVENUE GREENWICH CONN.

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Fine Finish**
- ★ **Flatness**
- ★ **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Grinding parallel sides on transmission gear blanks on the Blanchard No. 18 Surface Grinder

THE transmission gear blanks, shown above, are ground on a Blanchard No. 18 Surface Grinder. They are held on the 30″ Blanchard magnetic chuck. The blanks are 3½ inches in diameter and are made of forged alloy steel. .020 inches of stock is removed from each side to limits of .0005″ for parallelism. Blanchard Grinding produces accurate blanks that stack and cut well—and produces them at a rate of 250 (500 surfaces) per hour.

The BLANCHARD MACHINE COMPANY

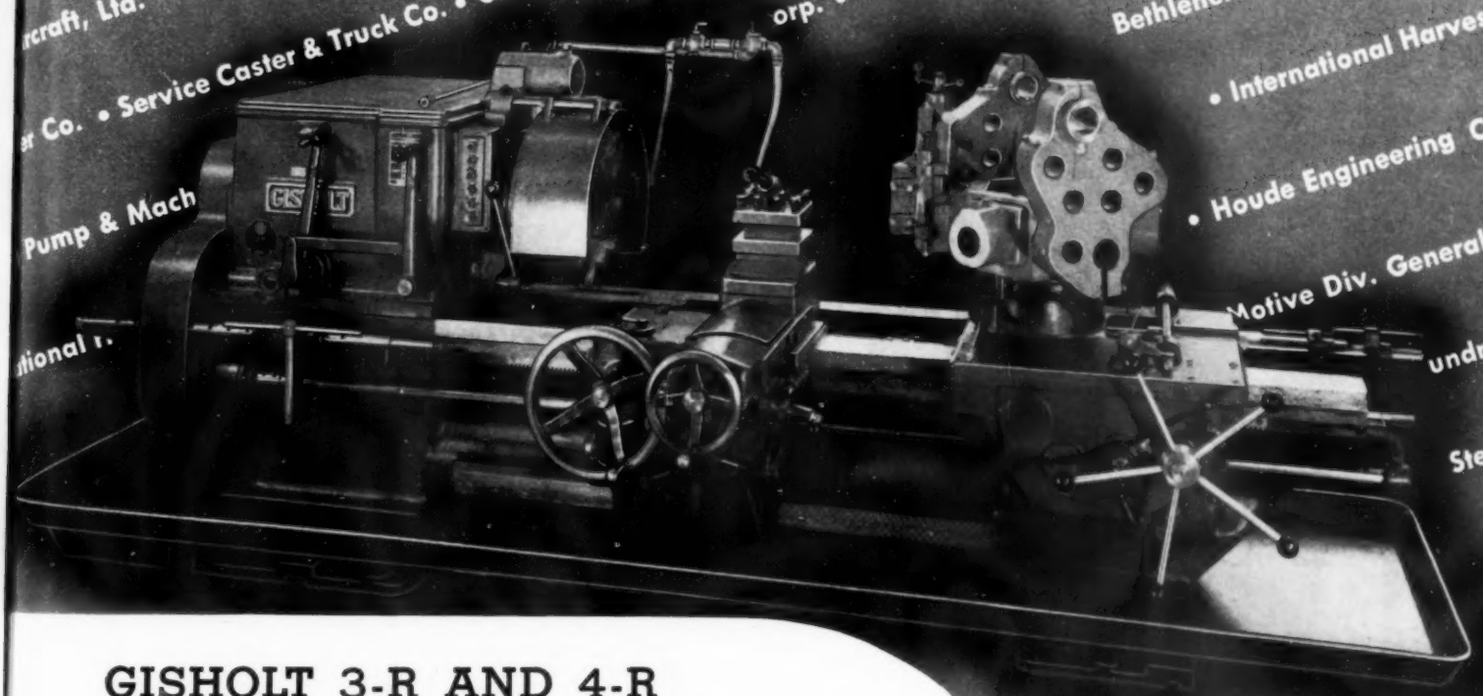
64 STATE STREET, CAMBRIDGE, MASS.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Patronage of world-known names

is significant



GISHOLT 3-R AND 4-R SADDLE-TYPE TURRET LATHES

The immediate acceptance of these new Gisholt lathes by leading manufacturers, indicates the sound engineering principles they embody and the important contribution they are making to the war effort.

The Gisholt 3-R and 4-R models are large, saddle-type turret lathes, built in two sizes: 21″ and 24″ chucks; 5¼″ and 9¼″ spindle bores. Literature on request.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue
Madison, Wisconsin

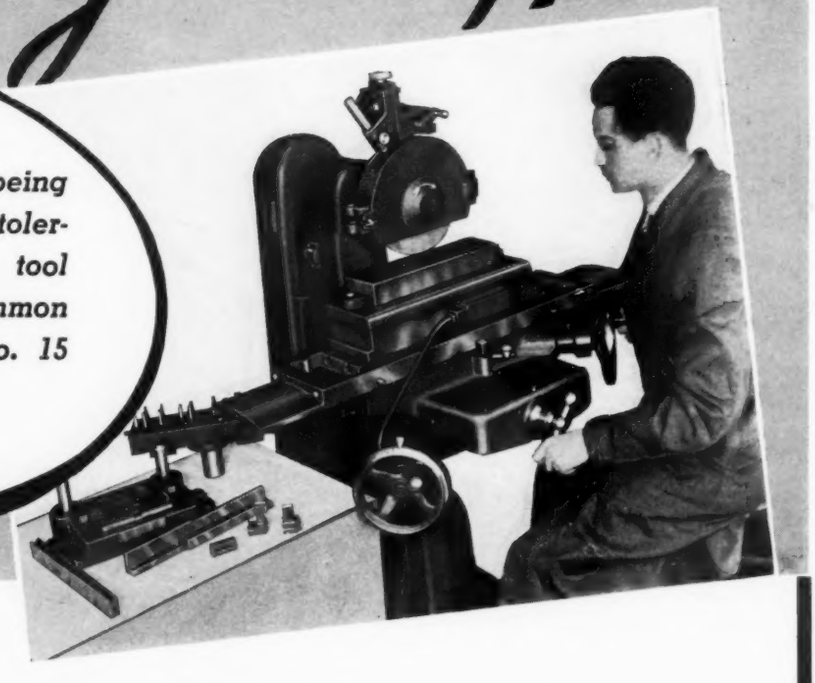
GISHOLT

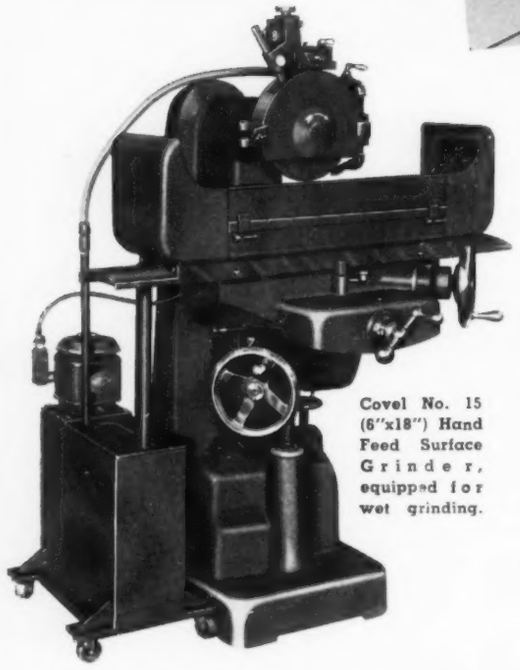
Look Ahead—Keep Ahead With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Gain on Grinding Time!

Here a stamping die is being ground to a very close tolerance, which a leading tool manufacturer states is common practice on his Covel No. 15 Surface Grinders.





Covel No. 15 (6"x18") Hand Feed Surface Grinder, equipped for wet grinding.

. . . and you can get PROMPT DELIVERY on the COVEL No. 15 Hand Feed Surface Grinder!

Covel's intensive production makes *prompt delivery to war industries* possible. This high-speed, easy-to-operate surface grinder is a low-cost production weapon which you can put into the hands of your operators *now!*

Write, wire or phone today for detailed information and specifications contained in Covel's Bulletin A 102-2.

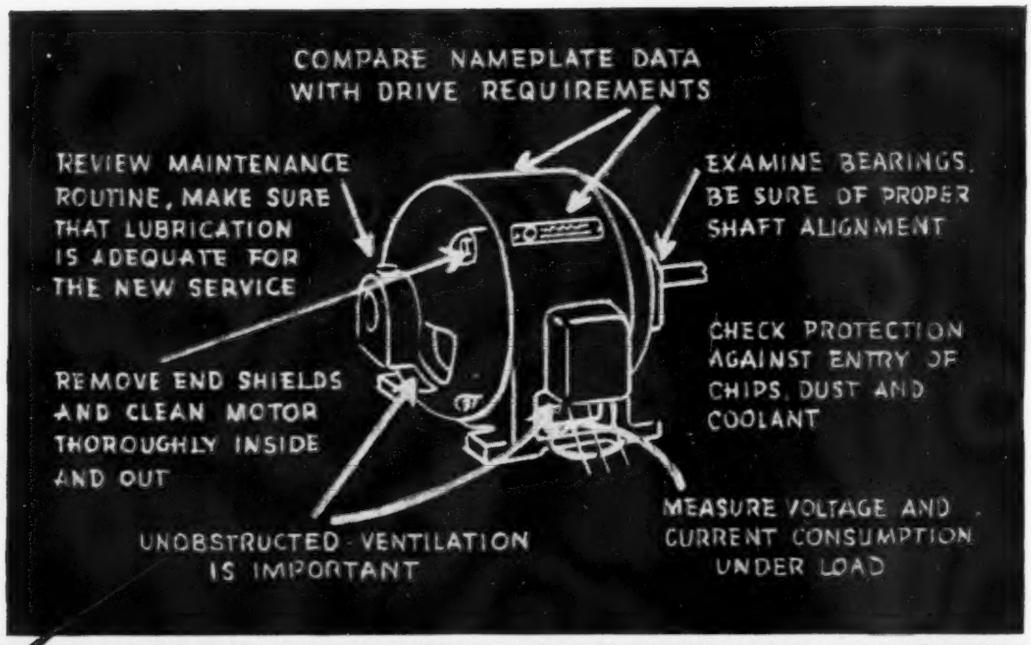
Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

No pause need refresh them
When time, space and manpower are precious, the tireless performance of fast, dependable multiple spindle automatics is appreciated.
Although machines may not tire, their operators often do. Simplicity and convenience of operation are important factors of a good machine.
The Departmental Design of a Conomatic contributes much to its efficiency and ease of operation. The tooling area, work-head, overhead camshaft, and controls, are in orderly arranged units, conveniently accessible from either side of the machine.
These conveniences contribute to the effective results that good operators are getting from 4, 6 and 8 Spindle Conomatics.
Prime your production pulse by specifying CONES.
CONE
Cone Automatic Machine Co., Inc., Windsor, Vermont

it's time to be a crank about


COMPARE NAMEPLATE DATA WITH DRIVE REQUIREMENTS
REVIEW MAINTENANCE ROUTINE, MAKE SURE THAT LUBRICATION IS ADEQUATE FOR THE NEW SERVICE
EXAMINE BEARINGS. BE SURE OF PROPER SHAFT ALIGNMENT
CHECK PROTECTION AGAINST ENTRY OF CHIPS, DUST AND COOLANT
REMOVE END SHIELDS AND CLEAN MOTOR THOROUGHLY INSIDE AND OUT
UNOBSTRUCTED VENTILATION IS IMPORTANT
MEASURE VOLTAGE AND CURRENT CONSUMPTION UNDER LOAD

protect your production with this maintenance plan

Planned motor maintenance, keyed to today's loads and conditions, saves vital hours of production time by forestalling future breakdowns and delay. In replacing hit-or-miss motor servicing with a regular schedule of trouble-*prevention*, you'll find real help in G-E *Motor Fitness Manual*.

The check list (right) tells what to do. The *Manual* tells how to do it, using well-proved methods that save time and help assure long-lasting motor service.

And, of course, your local G-E Motor Representative is always ready to aid you in putting these suggestions into practice, or in getting the new motors you may need for essential wartime jobs.

General Electric, Sec. B 750-152
Schenectady, N. Y.

Yes, send me a copy of "How to Care for Motors," GEA-2856A.

Name.....

Title.....

Company.....

Address.....

City..... State.....

8030

MOTOR FITNESS MANUAL

. . . for plants converted to war production. Tells what to do to get the most out of motors, old or new. If you're undertaking new work on motor-equipped machines, if you're "switching" motors from one job to another, or equipping machines with new motors, you'll find this bookful of helpful motor facts will save you valuable time. Write for a copy.

MOTOR CARE

HERE'S WHAT TO DO!

1. Make sure that motors are selected to *match the job.* Install motors so they are properly aligned with the driven load and are easily accessible for regular inspection.

The G-E Motor Fitness Manual tells how

2. Keep motors free from dust and dirt. Establish a definite cleaning schedule.

The G-E Motor Fitness Manual tells how

3. Be sure that lubrication is frequent enough to take care of increased production. See that employees are instructed as to proper methods. Also guard against over-lubrication.

The G-E Motor Fitness Manual tells how

4. A general overhauling of hard-worked motors will add years to their life. If your motors haven't had an overhaul in the last year, try to arrange your production schedule to permit one as soon as possible.

The G-E Motor Fitness Manual tells how

***IF YOU NEED NEW MOTORS** for important war work, check with your G-E Motor Representative on how to get Tri-Clad motors quickly.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

BUILDER OF

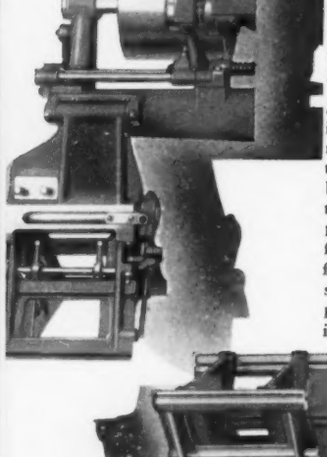
TRI-CLAD MOTORS

Reg. U.S. Pat. Off.

GENERAL ELECTRIC

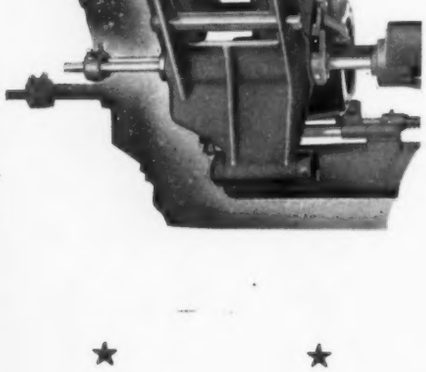
FOR MAKING STUDS—Caterpillar TRACTOR CO. MEETS PRODUCTION DEMANDS TODAY . . . WITH A HOPPER-FEED *Model 'B'* CLEVELAND AUTOMATIC

REG. U.S. PAT. OFF.



At left—Hopper Magazine shown in neutral position, hinged to bracket bolted to bed at rear of spindle head. In this position the machine is converted to regular bar feed.

Below—Hopper Magazine shown in operating position, swung upright and locked into position to hold the work. An oscillating bushing with open top, at bottom of guide bars, allows one piece to drop into position before push rod, which is cammed forward, feeding work through spindle and ejecting finished piece and bringing next piece in position for chucking.



• Lots of 6000 S.A.E. 1035 studs are produced from heat treated bar stock on this new Model B Cleveland Automatic of 1½-inch capacity, in a mid-western plant of the Caterpillar Tractor Co. With the installation of this machine they have obtained constant performance and better adaptability for set-up and accuracy over older equipment.

Operations on this stud are exceedingly simple for Model B. Bar stock, ½-inch diameter, is fed to gauge, and a coarse thread is cut ⅞-inch long, and stock is cut off. Pieces are then placed in hopper and gravity-fed to return through the spindle for the second operation, the cutting of a ⅞-inch long fine thread. (Note small illustrations at left. During first operation the hopper is swung down out of the way. For second operation hopper is swung upright and locked into position.)

Model B Clevelands up to 2½-inch capacity bar stock are built for thousands of metal turning jobs in industry where high production is a necessity. And versatile, high productive machines they are where work such as shafts of multiple diameters, various types of studs, nipples, tap blank and pins are required in quantity, but made accurately.

Built in short and long lengths, to accommodate work up to 18-inch stock feed, Model B can be equipped as here at "Caterpillar" with hopper-feed or rotary tilting magazines for secondary operations.

Cutting tools can be mounted singly or in series for turning one or more diameters of various lengths. Model B has double cross slides for forming tools and overhead slide for independent cut-off.

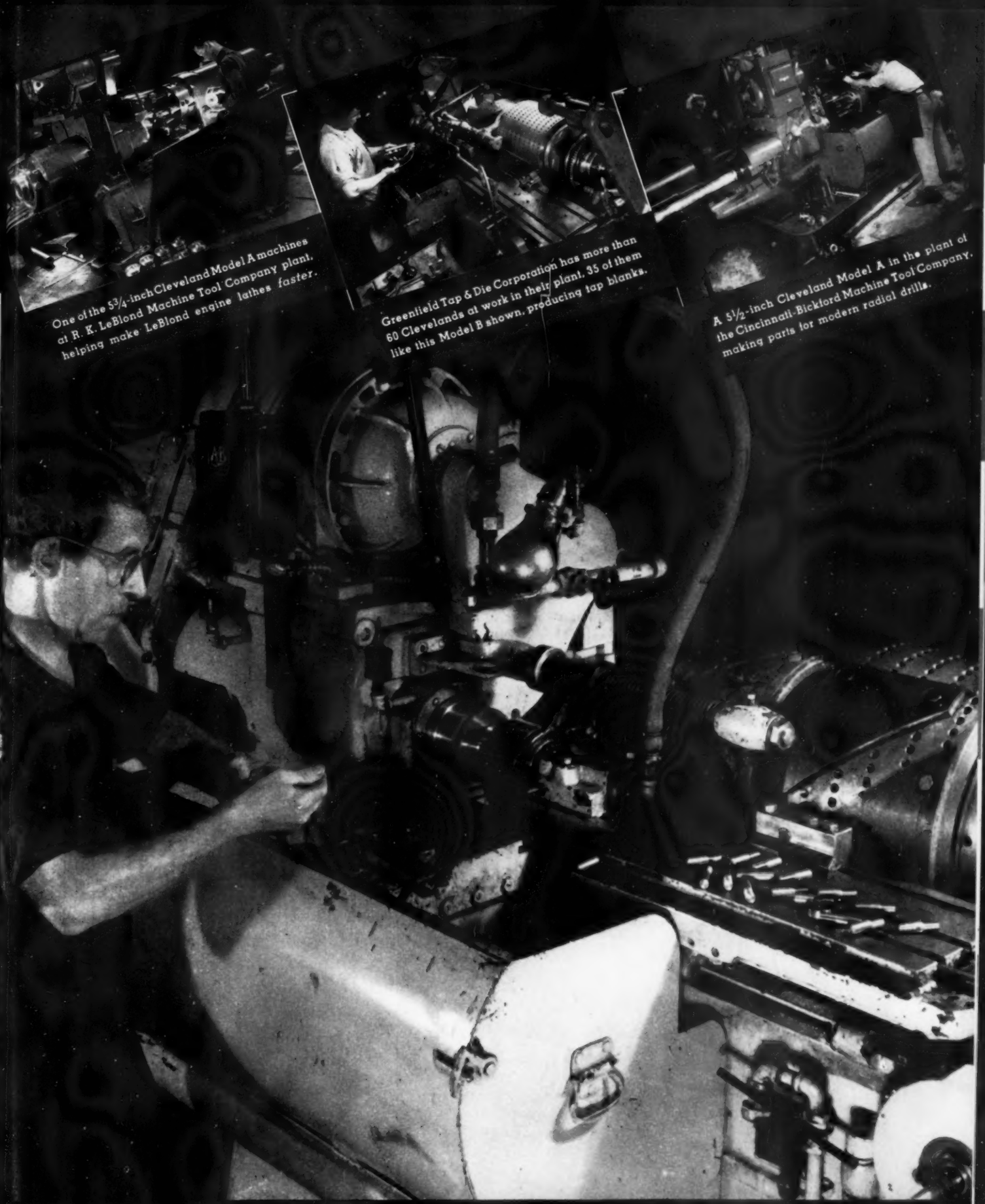
Maybe a Model B Cleveland can simplify and speed up your production. A Bulletin describing it more fully will be sent on request.

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 ASHLAND ROAD · CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland** ***Single Spindle*** **Automatics if you make duplicate parts in small quantities. By using** ***single spindle*** **automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**



One of the 5 3/4-inch Cleveland Model A machines at R. K. LeBlond Machine Tool Company plant, helping make LeBlond engine lathes *faster*.

Greenlield Tap & Die Corporation has more than 60 Clevelands at work in their plant, 35 of them like this Model B shown, producing tap blanks.

A 5 1/2-inch Cleveland Model A in the plant of the Cincinnati-Bickford Machine Tool Company, making parts for modern radial drills.

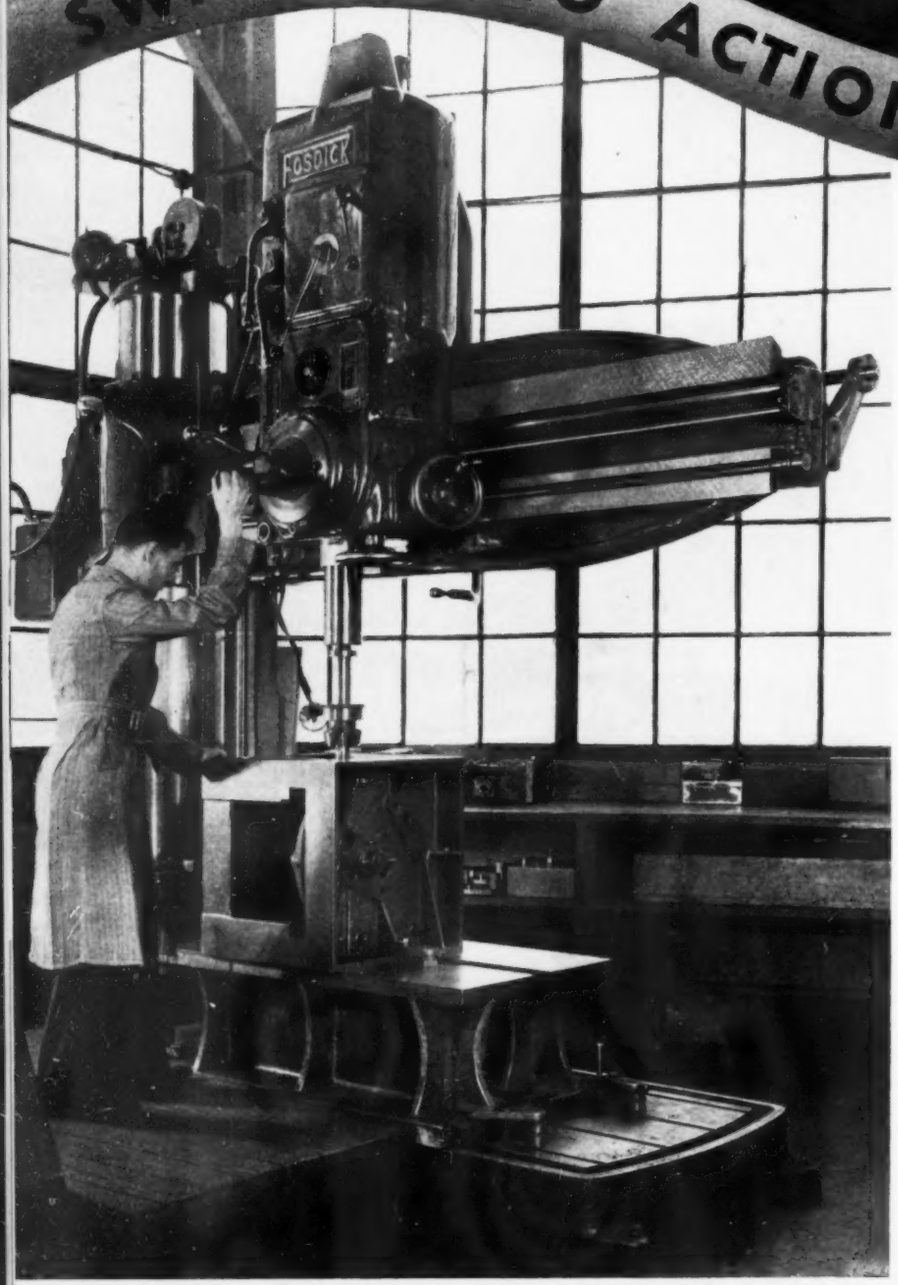
CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2 1/2-inch capacities inclusive

FOSDICK RADIAL

SWINGS INTO ACTION AT . . .



A PROMINENT MACHINE TOOL PLANT

A box jig is used to hold the work on this Fosdick Radial Drill for drilling—reaming or tapping various diameter holes from two or more sides.

The jig facilitates handling the work while the centralized control in the head make instantly avail able for the operator a selection of feeds and speeds as well as hand feed.

This is only one of many parts of various machines built by this concern that are drilled, tapped or bored on this Fosdick Radial quicker—easier—at lower cost.

If your work can be handled on a Radial put it on a Fosdick.

Fosdick Radial Bulletin RA gives full particulars. Write for one.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI . . . OHIO

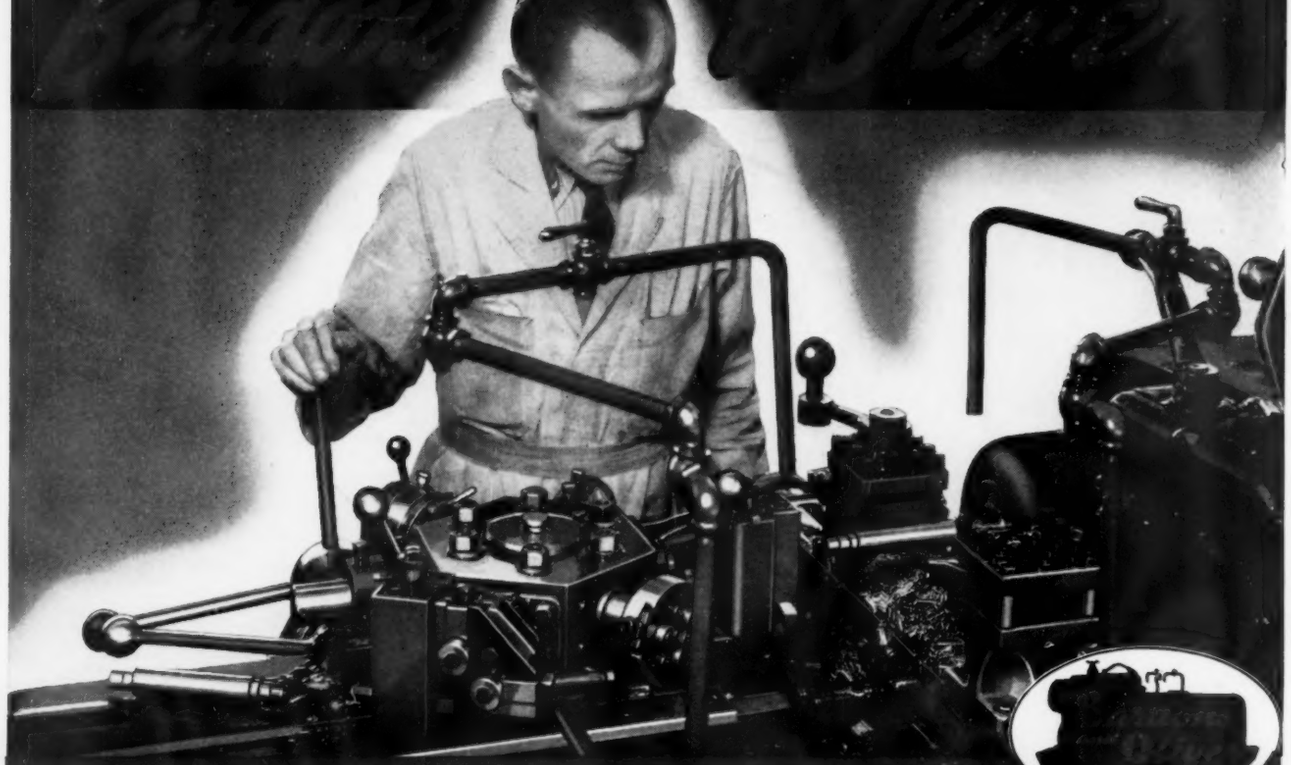
NEW VICTORIES IN "PRODUCTION NOW"

KEMPSMITH
TYPE "G" MILLER

brings new opportunities to industry for still greater production victories ... victories assured by Kempsmith's 54 years' engineering experience and cooperation in *production now* for the immediate war program ... victories that result from new power and speed, convenience and economy, plus precision and stamina for 24-hour days, 7 days a week! KEMPSMITH Type "G" Miller and the famous KEMPSMITH MAXIMILLER ... plain or universal ... are built to meet industry's needs of today and tomorrow!

KEMPSMITH TYPE "G"
UNIVERSAL MILLER
(shown above)

PRECISION
MILLING MACHINERY
Experience SINCE 1888
KEMPSMITH MACHINE CO.
MILWAUKEE • WISCONSIN



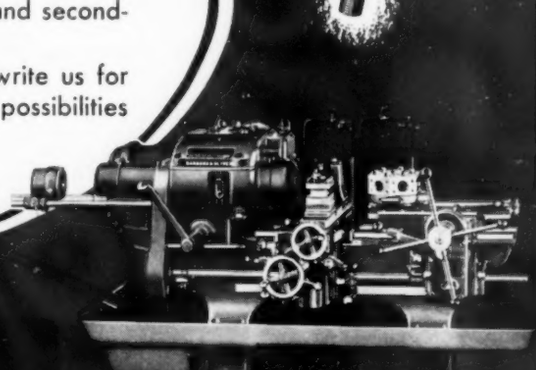
IF IT'S LOW COST OPERATION YOU WANT . . .

Put it on a Bardons & Oliver No. 3 UNIVERSAL TURRET LATHE

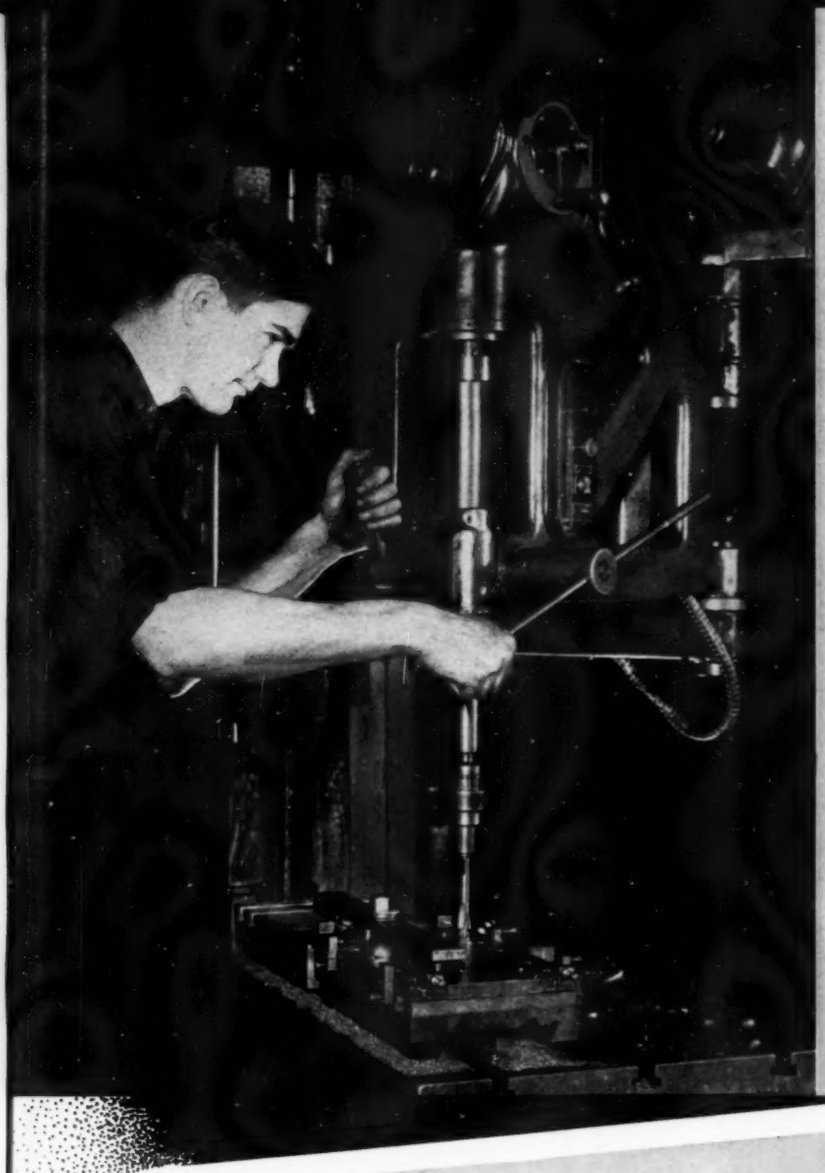
The production of small parts in large or small quantities at low cost is the result of developing the Bardons & Oliver No. 3 Universal Turret Lathe to its present high degree of efficiency. By concentrating all control levers within convenient reach, and by light and easy manipulation of tool slides and speed and feed changes the operator' fatigue is reduced to a minimum. Yet the powerful drive, together with great rigidity permits multiple cuts, rapid removal of metal and step-up of production.

Due to great versatility this turret lathe is capable of handling an extremely wide range of bar, chucking, and second-operation work.

So, if you are interested in low cost operation write us for further information regarding the features and possibilities of this turret lathe.

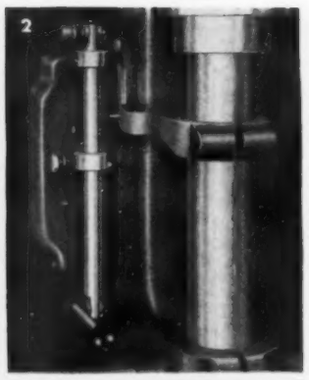


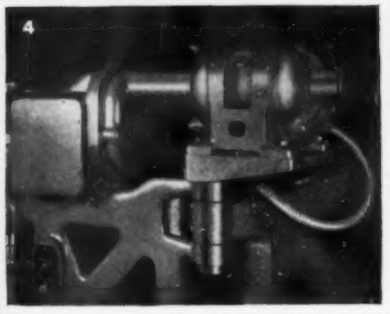
BARDONS & OLIVER, INC.
1133 W. 9th STREET • CLEVELAND, OHIO



FEATURES

1 *SIX QUICK SPEED CHANGES*
2 *FAST ACTION TAPPING CONTROL*
3 *ELECTRICAL ELEVATION OF DRILLING ARM*
4 *STANDARD TWO-SPEED MOTOR DRIVE*





CONVENIENT *Radial Drilling* FOR WAR WORK

THE HAMMOND unique hinged radial arm construction promotes the fastest possible machining through quick movement from hole to hole over a large layout. The spindle swings from spot to spot with a single movement, without lost motion. Six quick speed changes provide proper speeds for all operations and convenient controls and sturdy construction make fast drilling, tapping and counterboring possible at maximum speeds and feeds.

Write, wire or phone for price and delivery information.

THE FOOTE-BURT MACHINE COMPANY
Cleveland, Ohio

Formerly The Hammond Mfg. Co., Now owned by The Foote-Burt Co.

Also
HAMMOND SURFACE GRINDER

A 6" x 18" Surface Grinder built with extreme accuracy for the finest tool room or production use.

HAMMOND *Radial Drilling* MACHINES
Surface Grinding MACHINES

CUSHIONED LANDINGS

Save Ships and Pilots

Here a King Vertical Boring and Turning Mill is drilling—boring and reaming 4 inch diameter holes in chrome molybdenum parts for airplane landing gear.

The finished landing gear helps absorb landing shock thus saving wear and tear on the ships—and assuring safe smooth landings.

The power—speed and accuracy built into King Vertical Boring Machines assures close adherence to precision demands and production in line with war needs.

Put your Boring Mill work on a King and save time—worry—and costs.

KING BUILDS

Vertical Boring & Turning Machines in single column types from 30" to 42" and double column types up to 10 feet.

KING
MACHINE TOOL CO.

The KING MACHINE TOOL Company

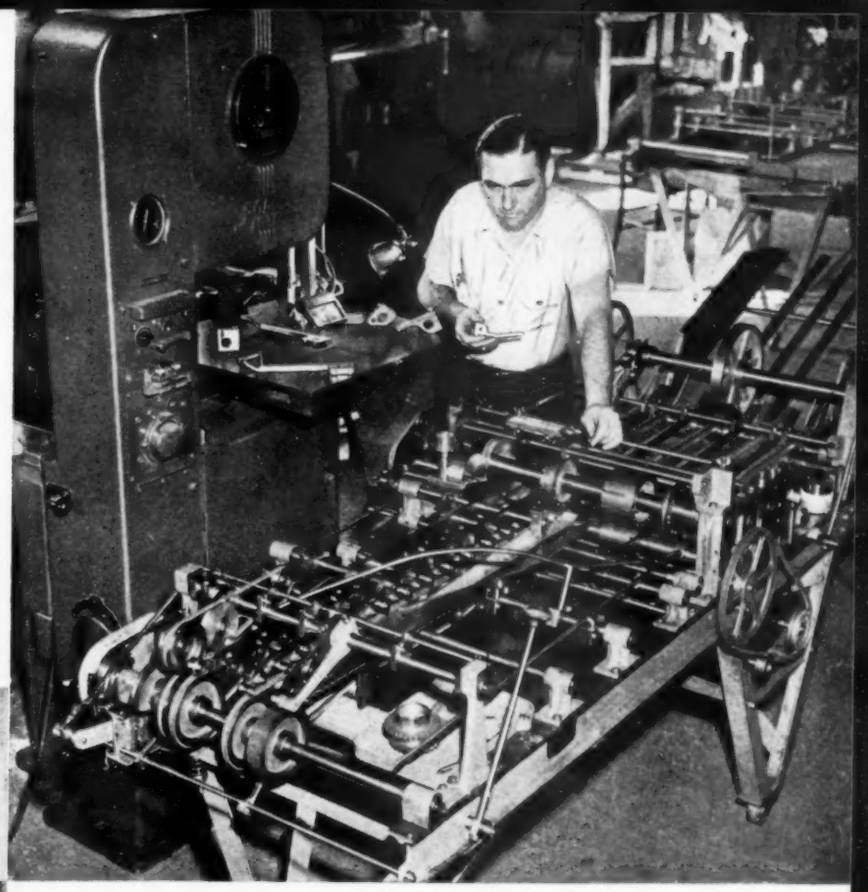
BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

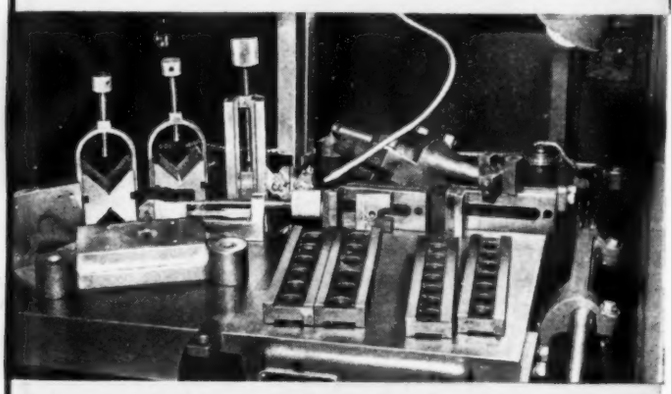
WHY WAIT WEEKS FOR TOOLS or PARTS?

Make them the same day on a

DoAll



25 different parts of this Automatic Paper File Folding Machine are now made on the DoAll—and without blueprints



All external and internal shape cutting in making these special parts and molds was done on the DoAll

In addition to doing a fine job in regular production work, the DoAll is the 100% patriot today to which you can turn in emergencies.

Don't tie up vital machines for weeks waiting for replacement parts from the factory. Make them on the DoAll—the fastest precision method for external and internal cutting without waste, of all kinds of metals, alloys, plastics, wood, etc. Finished jobs are ready for use—further machining is not necessary.

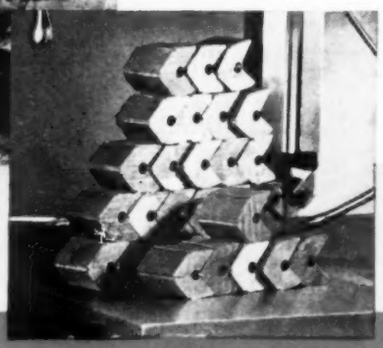
The DoAll makes special tools and dies, following a hair-line layout in the least possible time. Short runs of metal products can be handled on the DoAll, relieving heavier, higher-priced machine tools for other work. Sheet metal or alloy can be stacked and 20 to 80 parts cut out at one time.

ASK FOR DEMONSTRATION

A factory-trained man will call with a DoAll and show you its production versatility, economy and time-saving features.

READ THIS BOOK—Send for a copy of "DoAll on Production", a picture story of this little giant of industry.

A large airplane plant makes these Propellor Wrenches on the DoAll

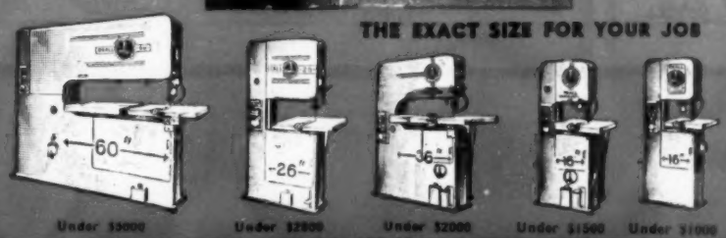


32 Stitching Dies 1¾" thick cut from oil hardening tool steel in 23½ hours on the DoAll.

CONTINENTAL MACHINES, INC.

1310 S. Washington Ave. Minneapolis, Minn.

Associated with the DoAll Company, DesPlaines, Illinois, Manufacturers of Band Saws and Band Files for DoAll Contour Machines



Pat. No. 2,255,577
Des. No. 127,313
Other Pats. Pending

To Finish The Job Quicker . . .

A LANDIS HEAVY

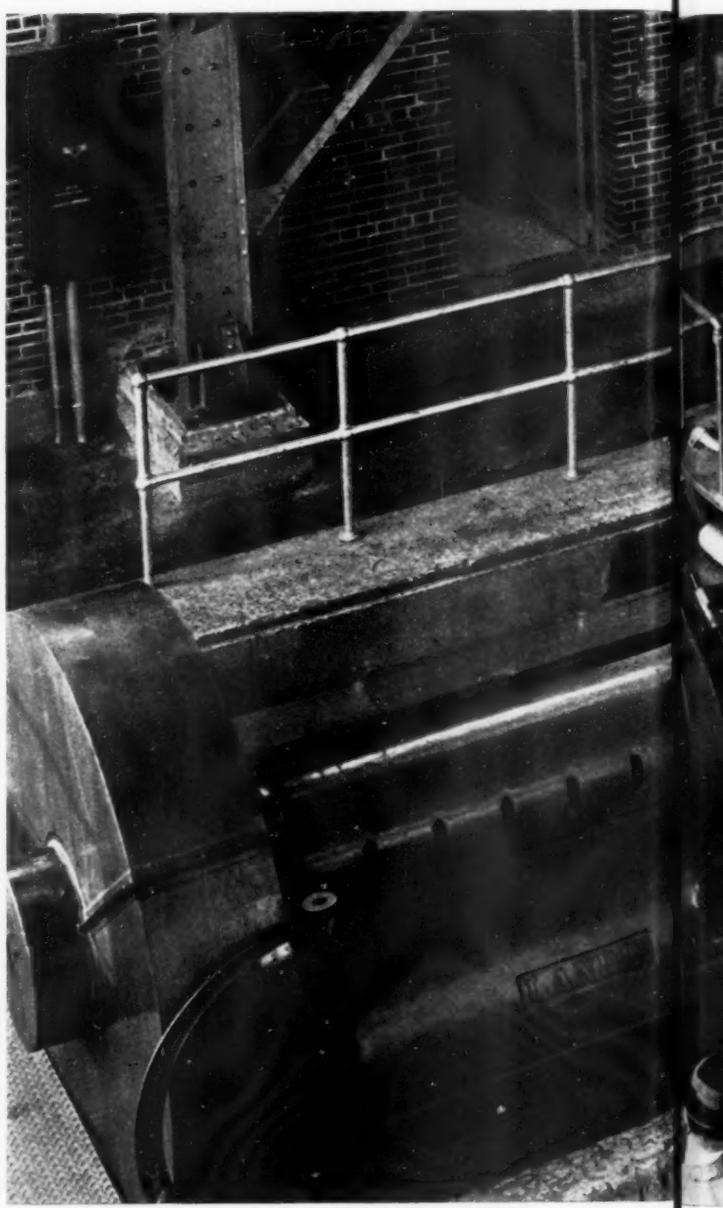
Like This . . .

The massive 44" x 288" Type 30 Roll Grinder shown on these pages is installed at the Lukens Steel Company, the home of the world's largest plate mill.

The productiveness of the Type 30 is a particularly valuable asset to this user in view of the abnormal demands for steel plate. As a matter of fact, the machine might be considered two grinders in one. It will remove stock rapidly, literally "hogging" metal with the heaviest of cuts. And then it will just as efficiently take the lightest of cuts required for rolls to which a high finish must be imparted.

Versatility is complete. Roll bodies may be ground straight, crowned or concaved. Roll necks may be ground when necessary. On top of this, a taper grinding attachment may be secured as extra equipment and utilized by those who have to grind rolls with tapered necks.

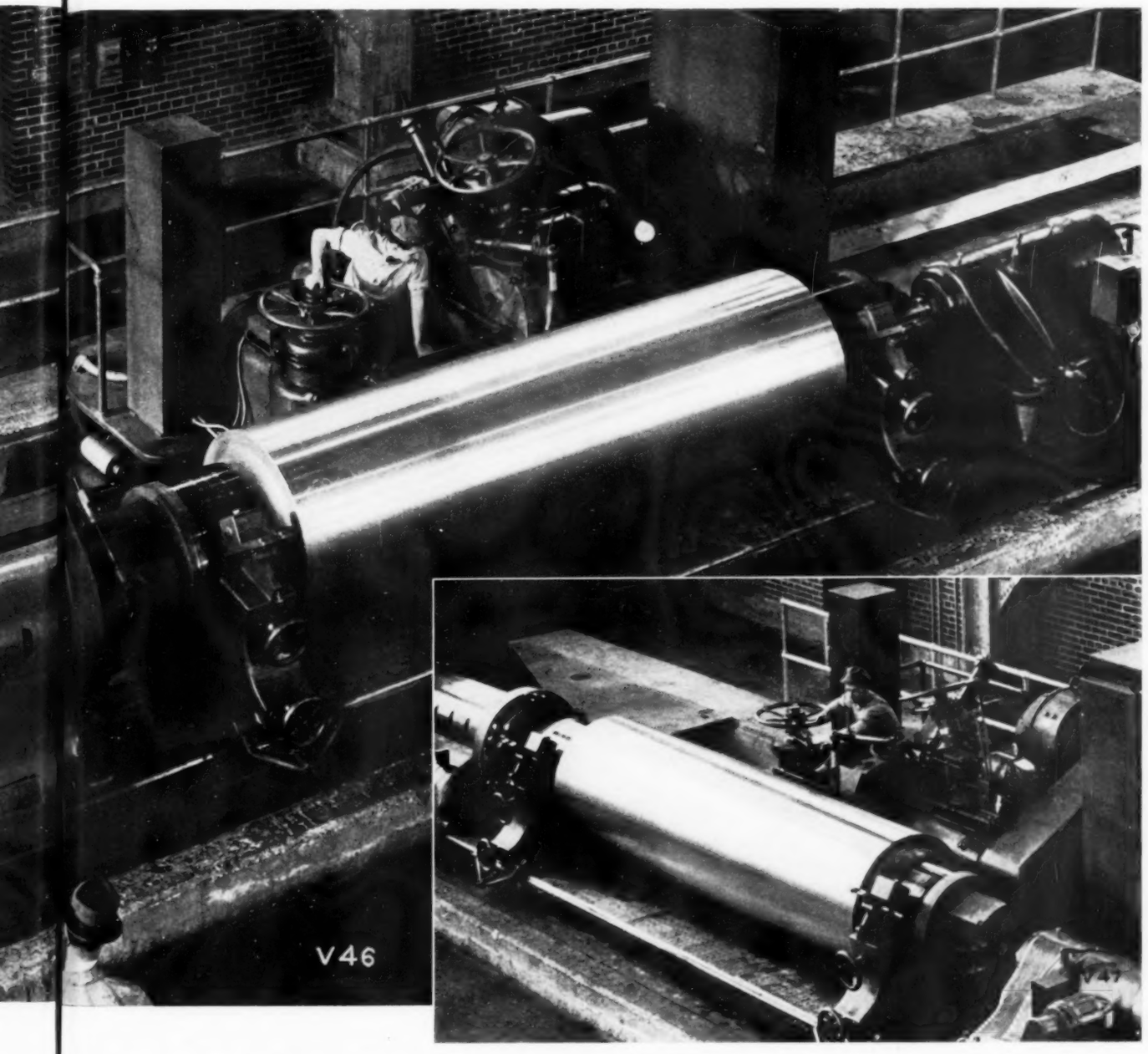
Dozens of these machines were servicing the rolls in many mills before the hectic period through which we are passing. Now they are all working even harder, in most instances twenty-four hours a day and seven days a week, to help keep plates rolling for the eventual use of our armed forces.



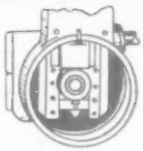
PRECISION LANDIS GRINDERS

Unusual Performance As Usual

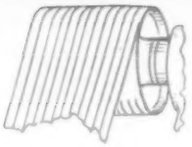
WEIGHT PERFORMS



LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA



POSITIVE CROWNING AND CONCAVING MECHANISM.



MULTIPLE V BELT WORK DRIVE.

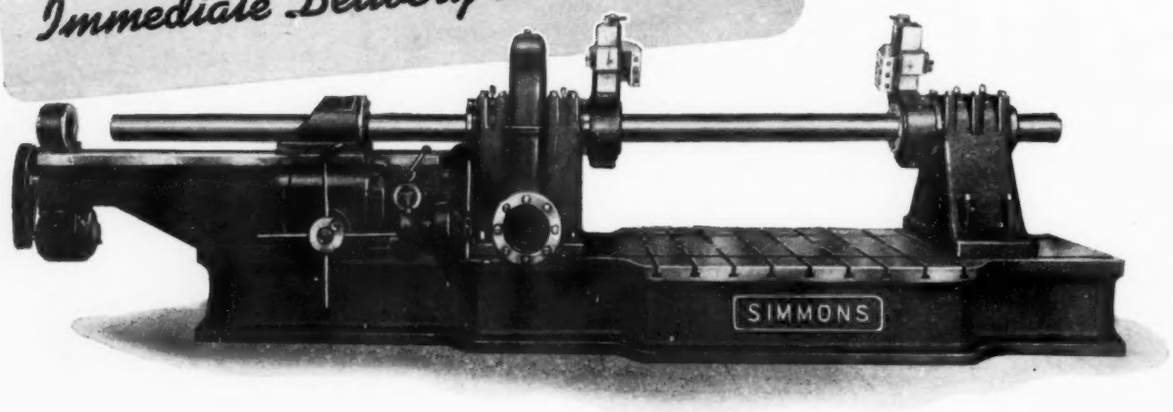
MASSIVE GRINDING WHEEL SPINDLE.

402

SIMMONS 6" BAR HORIZONTAL BORING AND FACING MACHINE

Immediate Delivery with 17' Bar

Equipped with SIMMONS *MICRO-FEED* UNIT



THIS new Simmons 6" Bar Horizontal Cylinder Boring and Facing Machine has been designed specifically to solve current war-production problems. The bed, which is of massive construction, is heavily ribbed to insure maintained alignment.

Equipped with Simmons Micro-Feed Unit, an infinitely variable transmission, this boring machine offers both fine and coarse feeds ranging from .004" to 1.000" per revolution of spindle. The boring bar is of turned and ground high-carbon steel, thoroughly normalized, with Brinnell hardness of approximately 220. Standard length of the boring bar is 17', but lengths up to 24' may be provided.

The main drive to the boring bar is obtained through a six-speed gear box, motor-driven. Gears are of high-carbon steel and mounted on spline shafts with anti-friction bearings running in oil. Power Rapid Traverse is supplied to the bar in both directions. *Write today for descriptive bulletin.*

SPECIFICATIONS

Diameter, Boring Bar	6"
Travel of bar in one setting	60"
Capacity of facing heads	9" to 38½"
Widened portion of bed	51½"x68", 18" high

SIMMONS MACHINE TOOL CORPORATION

***Main Office:* 1759 NORTH BROADWAY, ALBANY, N. Y. *New York Office:* 149 BROADWAY**

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

AUTOMATIC CHUCKING EQUIPMENT IS ANSWERING THE CALL

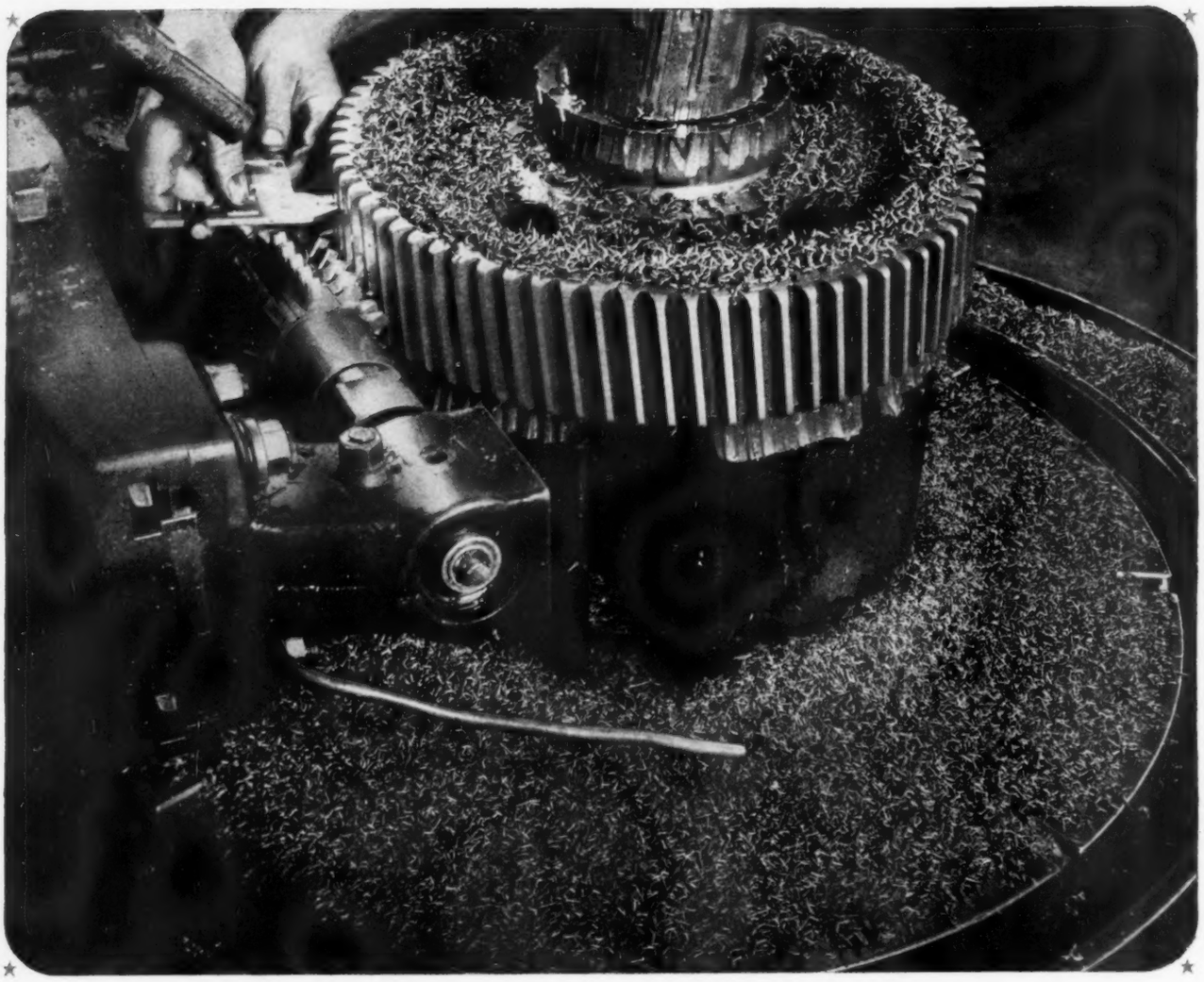
for "more"

Photo by U. S. Army Signal Corps

IT is quite natural that an organization which pioneered the development of equipment for producing accurate duplicate parts in quantity should be ready in a national emergency to contribute much to an expanded production program.

Potter & Johnston Automatic Chucking Machines are turning out accurate, difficult work, quickly and efficiently. Time per piece is being reduced and pieces per machine increased as P&J engineers apply their long experience and take full advantage of the unusual tooling facilities offered in P&J machines. Thus P&J is helping to answer the call for more airplanes, airplane engines, tanks, guns and a host of other essential war equipment.

THE POTTER & JOHNSTON MACHINE COMPANY, PAWTUCKET, R. I.



KEEP 'EM CUTTING . . AND SAVE THE PIECES

IN this war, machine tools on the average are cutting away steel at a rate more than 12 times faster than in 1918. That's production—keep them cutting!

Keep them cutting *faster* by selecting tool steels more closely suited to the job. Case after case in our files show increases in feeds, speeds, or pieces per grind—increases, often, of 50% and more—when the *right* tool steel went to work.

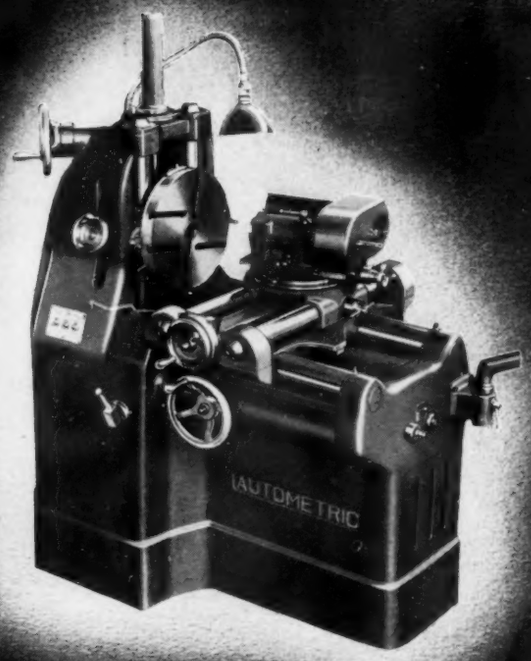
Keep them cutting *constantly* by knowing the best alternate tool steel for each job. Know it, and know its performance, as insurance against a time when your first-choice steel may be short in supply.

And save the pieces! Every particle of steel, especially High Speed Steel, is important, and much critical alloy material can be saved for re-use if proper methods of reclamation and classification are employed. Let our Service Staff help with your problems of tool steel selection, treatment, use and salvage.

AL

STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA



AUTOMETRIC
JIG BORING MACHINE
MODEL "A"

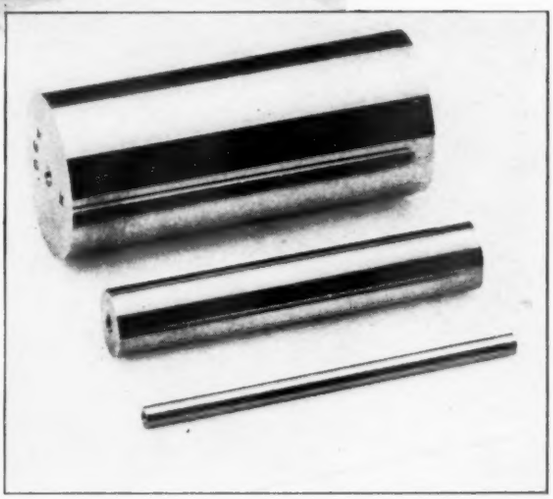
ANNOUNCEMENT . . .

THE complete line of Autometric Jig Boring Machines, formerly built by the Autometric Machine Tool Company of Berkeley, California — is now being produced by the Kearney & Trecker Products Corporation of Milwaukee, Wis. There are three machines in the line — two horizontal and one vertical. Each is designed to handle a wide range of precision work. Speed, flexibility and extreme accuracy are hi-spot features . . . The Autometrics will have the same high-quality construction as that found in other well-known equipment designed and built by the Kearney & Trecker Products Corporation.

KEARNEY & TRECKER PRODUCTS CORPORATION
A Subsidiary of the Kearney & Trecker Corporation
MILWAUKEE, WISCONSIN

AUTOMETRIC
JIG BORING MACHINE
MODEL "B"

Measuring pitch diameter of thread gage with Van Keuren "Best Size" wires which touch the thread at or near the pitch diameter.



Van Keuren

HEADQUARTERS FOR MEASURING WIRES

Standard Equipment in Government and Industrial Plants

• Van Keuren measuring wires are the accepted standard equipment for making measurements on thread gages, taps, worms, splines and spur gears. We carry a complete stock of sizes for measuring U.S. Standard, Whitworth, Metric, British Association, Pipe, Acme and 29° Worm threads. Special wires of any diameter in the range from .002" to 1.5708" are made to order. Our large supply of blanks insures prompt delivery.

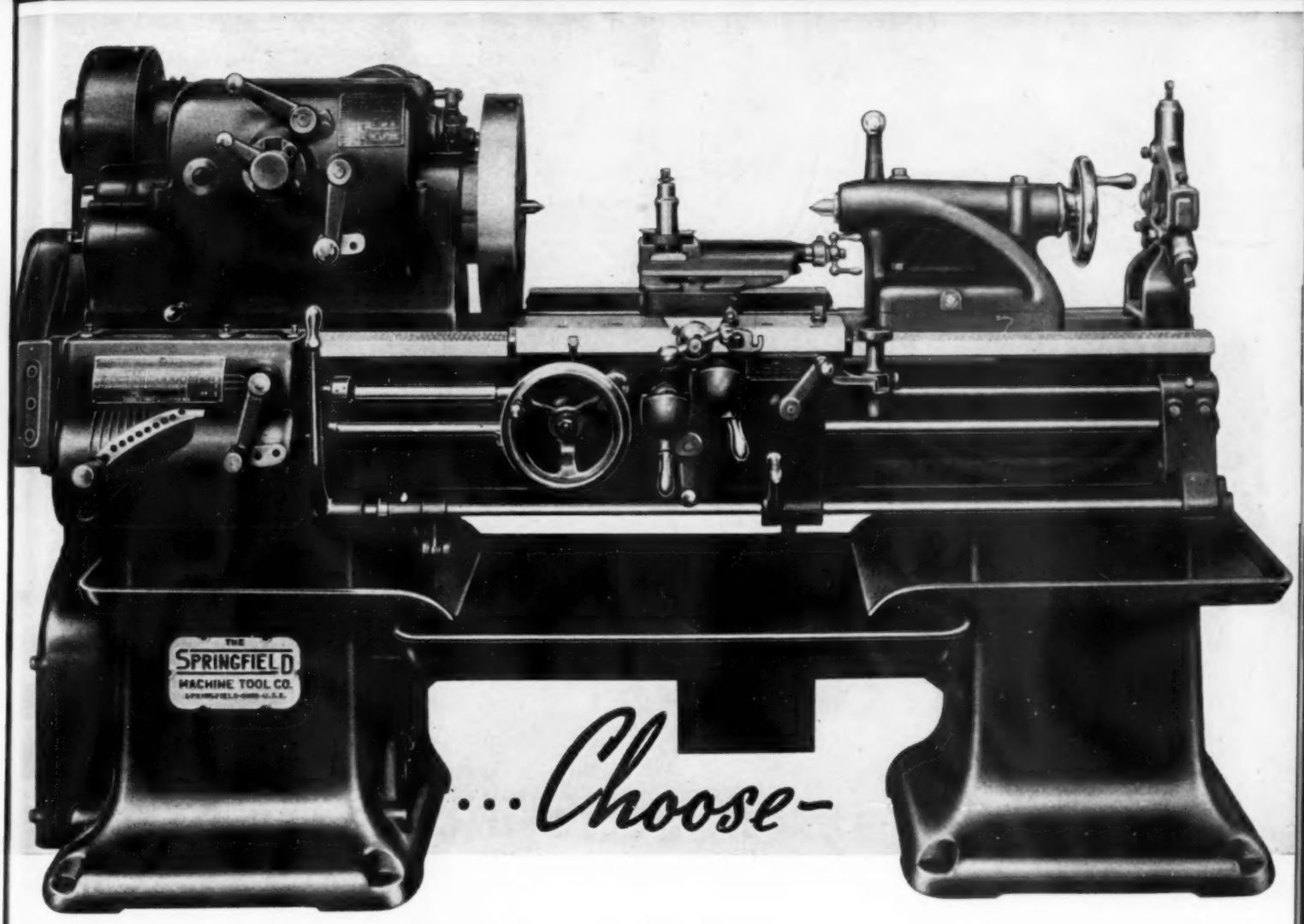
Van Keuren thread measuring wires are manufactured to National Bureau of Standards specifications. They are hardened, ground and lapped by precision methods developed over a quarter-century. Standard thread sizes are accurate within .00002" for roundness and straightness and within plus or minus .000025" for size. Special sizes are made to any tolerance required.

It is easy to use Van Keuren wires. Catalog 31 gives simplified formulae for measuring all standard threads, splines and spur gears. We will be pleased to send you Catalog 31 without charge upon request.

THE Van Keuren COMPANY 176 WALTHAM ST., WATERTOWN, MASS.

LIGHT WAVE EQUIPMENT • LIGHT WAVE MICROMETER • MICROGAGES • TAPER INSERT PLUG GAGES • WIRE TYPE PLUG GAGES
MEASURING WIRES • THREAD MEASURING WIRES • GEAR MEASURING SYSTEM • SHOP TRIANGLES

Consider the Future...



...Choose-

SPRINGFIELD GEARED HEAD LATHES

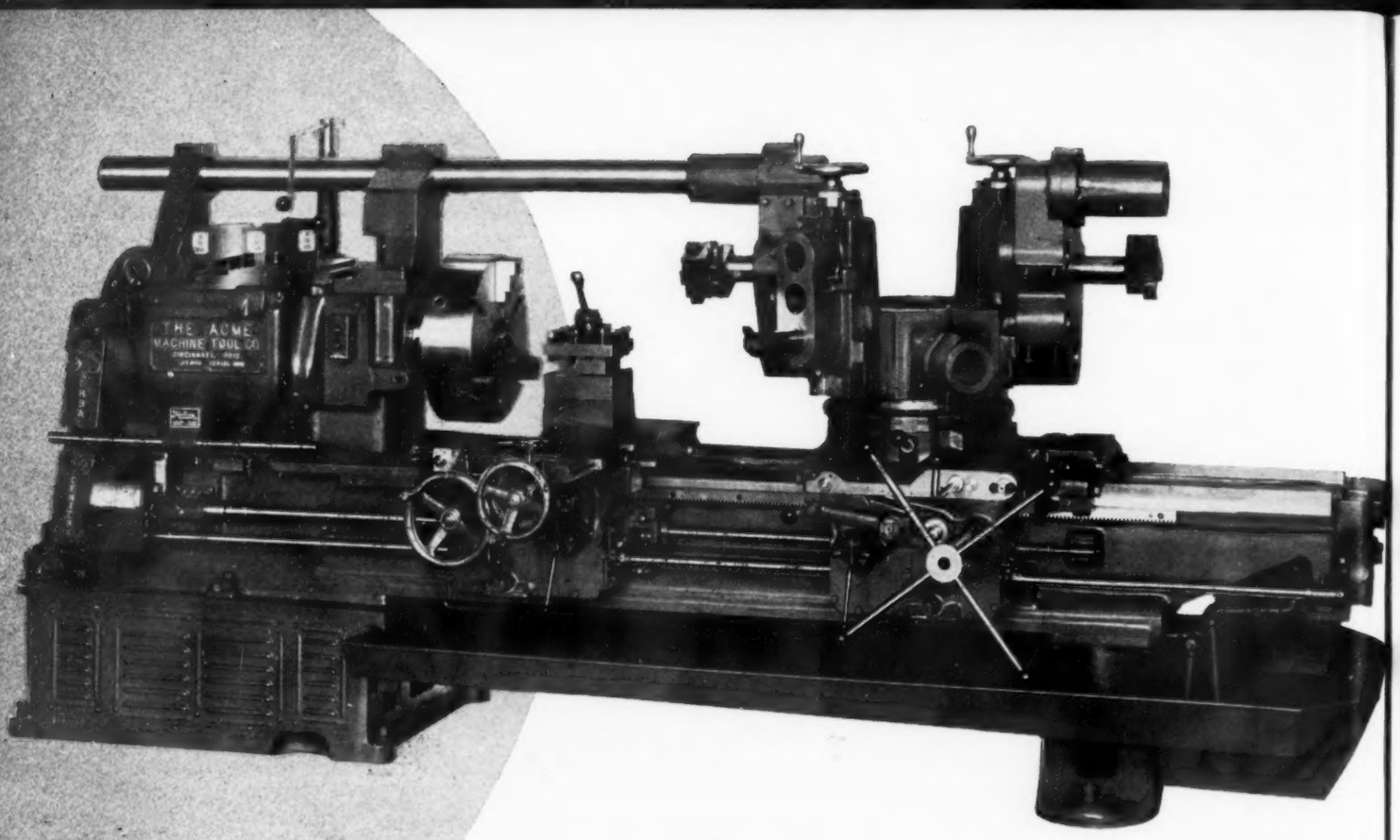
It's natural to assume that a great percentage of your present production is for war . . . that a great deal of your capacity is turned to the making of weapons to fill the needs of an ever expanding air force, army and navy. But, *don't neglect the future . . . buy with an eye to a tool's usefulness under normal manufacturing conditions,* as well as the emergency conditions that exist today.

At present, a great percentage of SPRINGFIELD units are going directly into war work. Here, the many qualities that have always distinguished SPRINGFIELDS . . . accuracy, unexcelled service 24 hours a day, minimum maintenance, variety of uses, and many more . . . are bringing *lower-cost production.* But the purchasers of these units have considered carefully and have chosen SPRINGFIELD *not only for present output, but for future quality production.*

So, *consider the future* . . . choose SPRINGFIELD. Our engineers are constantly in touch with the field, gathering information so as to design lathes and attachments ideally suited for present and future uses. *To invest in the future, buy SPRINGFIELD* . . . Geared Head Lathes in sizes from 14" to 30".

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.



CINCINNATI ACME

RESPONDS TO INCREASED DEFENSE EFFORT WITH THE *NEW 3S-ACME* UNIVERSAL TURRET LATHE!

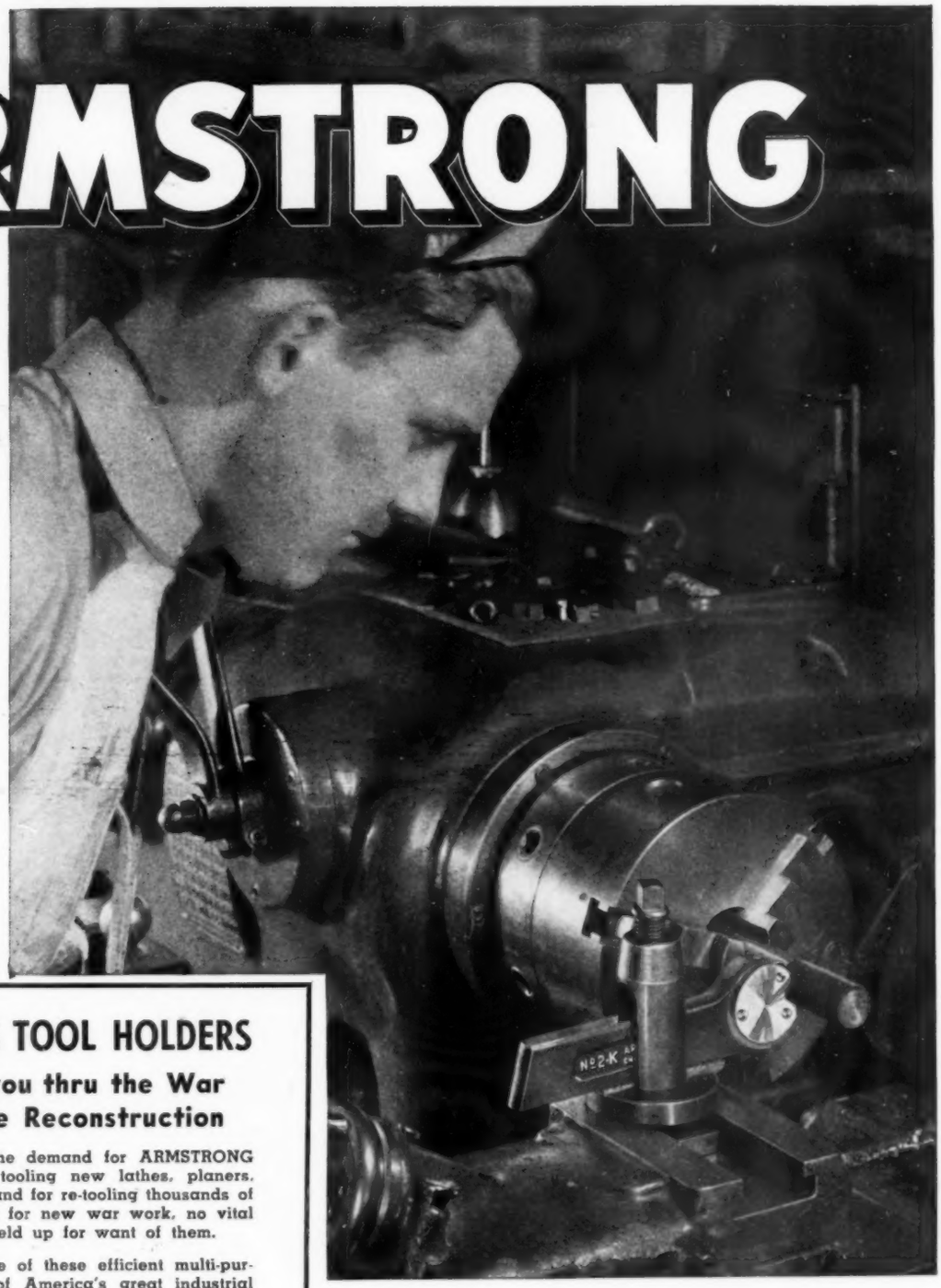
• The 3S-ACME is a machine of improved design and large capacity with abundant power and rigidity plus ample speeds and feeds to meet demands of carbide and other high production tools so necessary to speeding up defense operations.

This ACME features a stationary overhead pilot bar which not only makes for increased accuracy but for speeding up operation on jobs requiring rigid support to cutting tools. Another advantage is the safety factor, as there is no overhanging bar projecting from the turret to cause trouble for operator.

It is built in 24" and 28" Swing for chucking work and up to 4¼" diameter Bar Capacity.

The ACME MACHINE TOOL CO.. ...CINCINNATI, OHIO

ARMSTRONG



ARMSTRONG TOOL HOLDERS

will carry you thru the War and also the Reconstruction

Great as has been the demand for ARMSTRONG TOOL HOLDERS for tooling new lathes, planers, slotters and shapers; and for re-tooling thousands of existing machine tools for new war work, no vital war work has been held up for want of them.

In the universal use of these efficient multi-purpose tools, lies one of America's great industrial advantages—America's ability to (1st) change-over immediately to the manufacture of production of war tools, jigs and fixtures, (2nd) the ability to safely step-up speeds and feeds to the full capacity of the machine tool — for ARMSTRONG TOOL HOLDERS will stand up to any cut a machine tool can attain, (3rd) the ability to make each ounce of critical high speed steel do 10 times the work it can do in countries dependent on hand forged tools—ARMSTRONG TOOL HOLDERS Save 90% High Speed Steel.

When the war is won these same ARMSTRONG TOOL HOLDERS will give America the same advantages in changing back to peacetime industry . . . for ARMSTRONG TOOL HOLDERS are *permanent* tools that give many years of service.

ARMSTRONG BROS. TOOL CO.

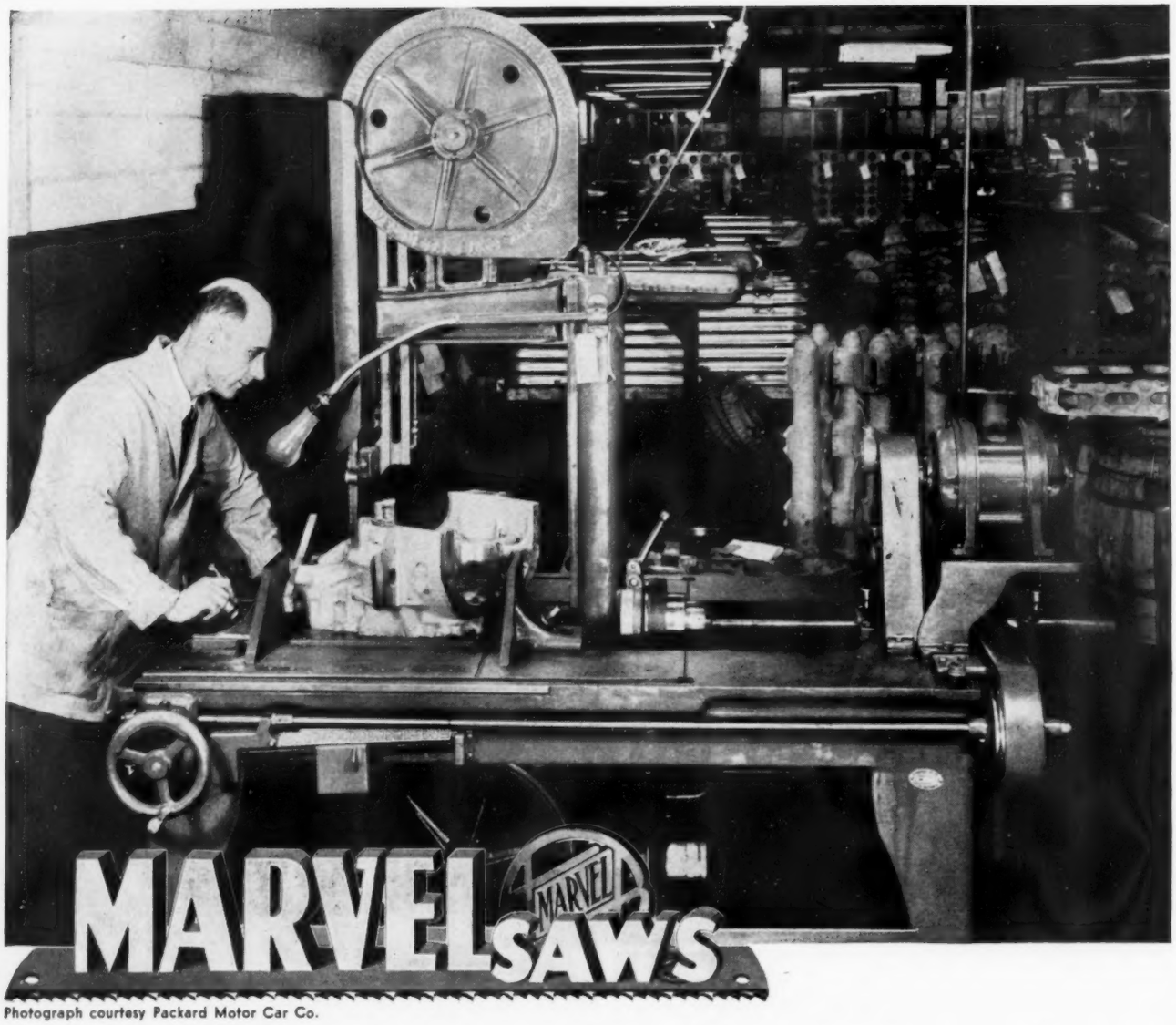
"The Tool Holder People"

315 N. Francisco Ave. Chicago, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., N. Y.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms



Photograph courtesy Packard Motor Car Co.

A MARVEL No. 8 Speeds All-out Production of Packard Rolls-Royce Aircraft Engines

MARVEL Sawing Machines are playing an important part in speeding production for National Defense. Not only the MARVEL 6A and 9A High-Speed Production Saws that automatically cut-off rifle barrels, gears and parts from bar stock in great quantities; or the giant MARVEL No. 18 Hydraulic Saw so well known for its cutting Speed; but all other MARVEL Saws, too, each in its own way, are at work in America's "all-out production." Take for example, the MARVEL No. 8 Universal Band Saw illustrated above, working on aircraft engine crankcases in the "D" Division of the new Packard Rolls-Royce Engine Plant.

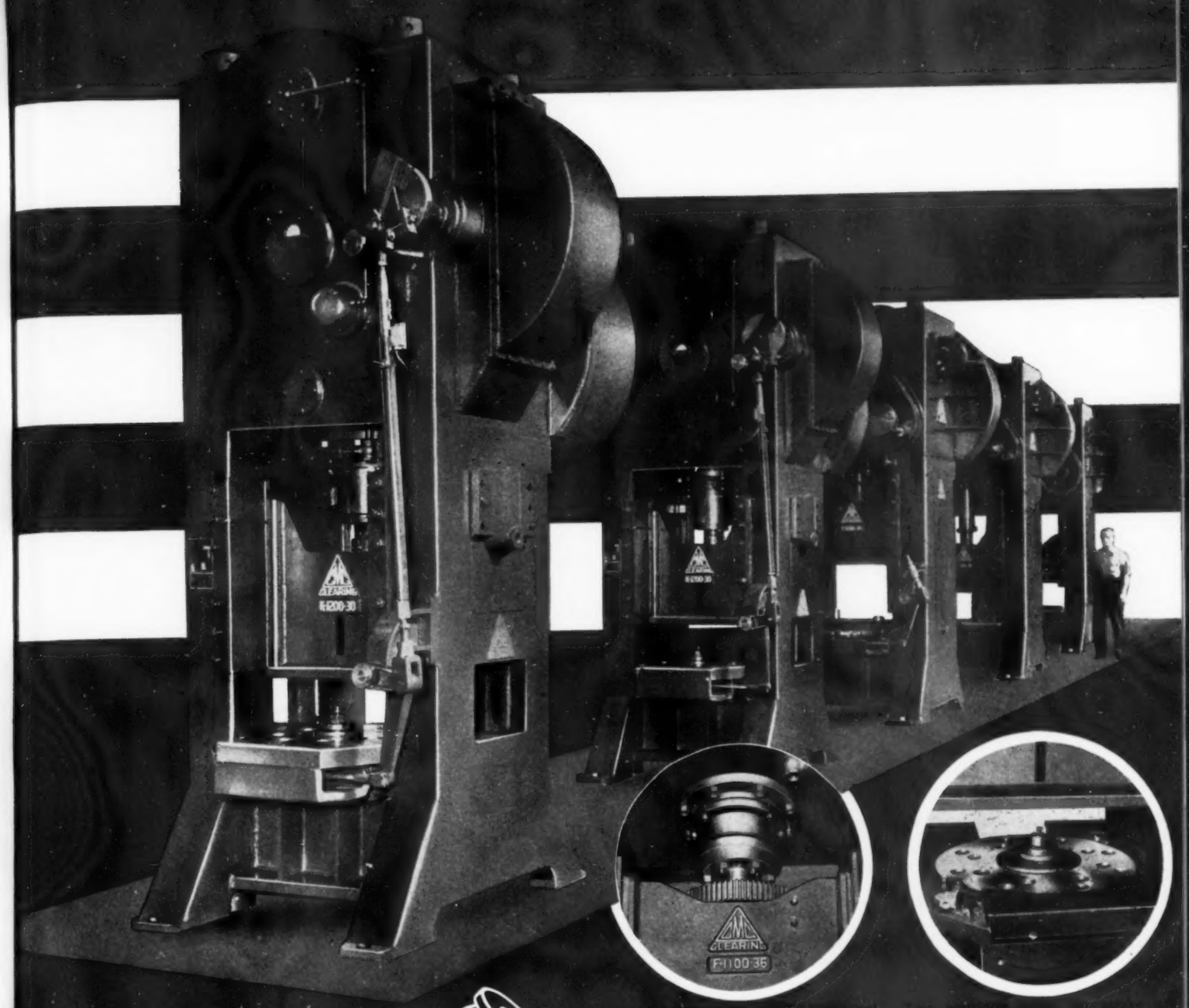
Because of its large capacity (will handle work up to 18" x 18"); because it cuts at any angle from 45° right to 45° left; and because the blade remains vertical throughout its straight-forward carriage travel, the MARVEL No. 8 will do trimming, notching, mitering and cutting-off, and will save hours of machining by roughing out work to size and shape.

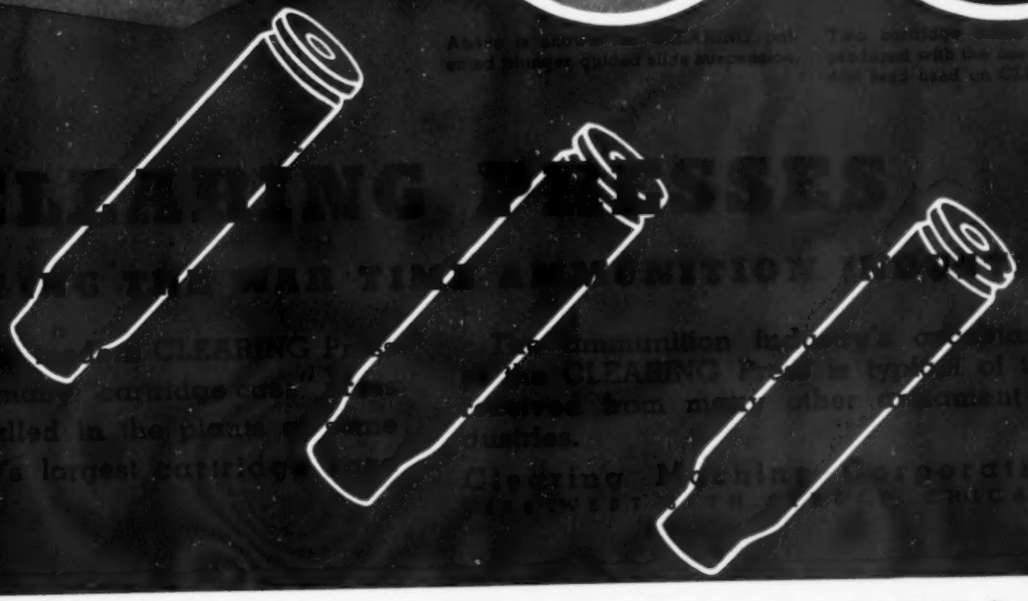
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. **Chicago, U. S. A.**

Eastern Sales Offices: 225 Lafayette St., New York





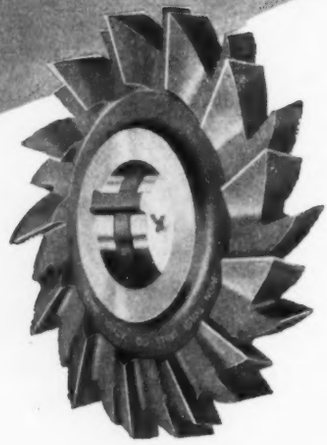
MECHANICAL AND HYDRAULIC PRESSES

CLEARING

MACHINE CORPORATION

CHICAGO

Twist Drills—Milling Cutters —Reamers—Hobs—Slittings Saws—End Mills—Taps—Dies —Screw Plates—Profile Cutters—



EVERY SMALL TOOL JOB IS AN OPPORTUNITY FOR A SAVING

Completeness of the UNION line makes it possible to realize BIG SAVINGS on many operations. Milling, drilling, reaming, hobbing, slitting, tapping, threading, cutting can be speeded up and costs reduced by these modern, fast, accurate tools.

Cost minded production men know from experience that UNION tools can always be depended on for economy and increased cutting efficiency over long periods between grindings.

Because of the wide range of tools in the UNION line, with each tool designed for maximum results, standardization on UNION tools can mean an overall total saving of substantial proportions. Put UNION tools to work and see for yourself.

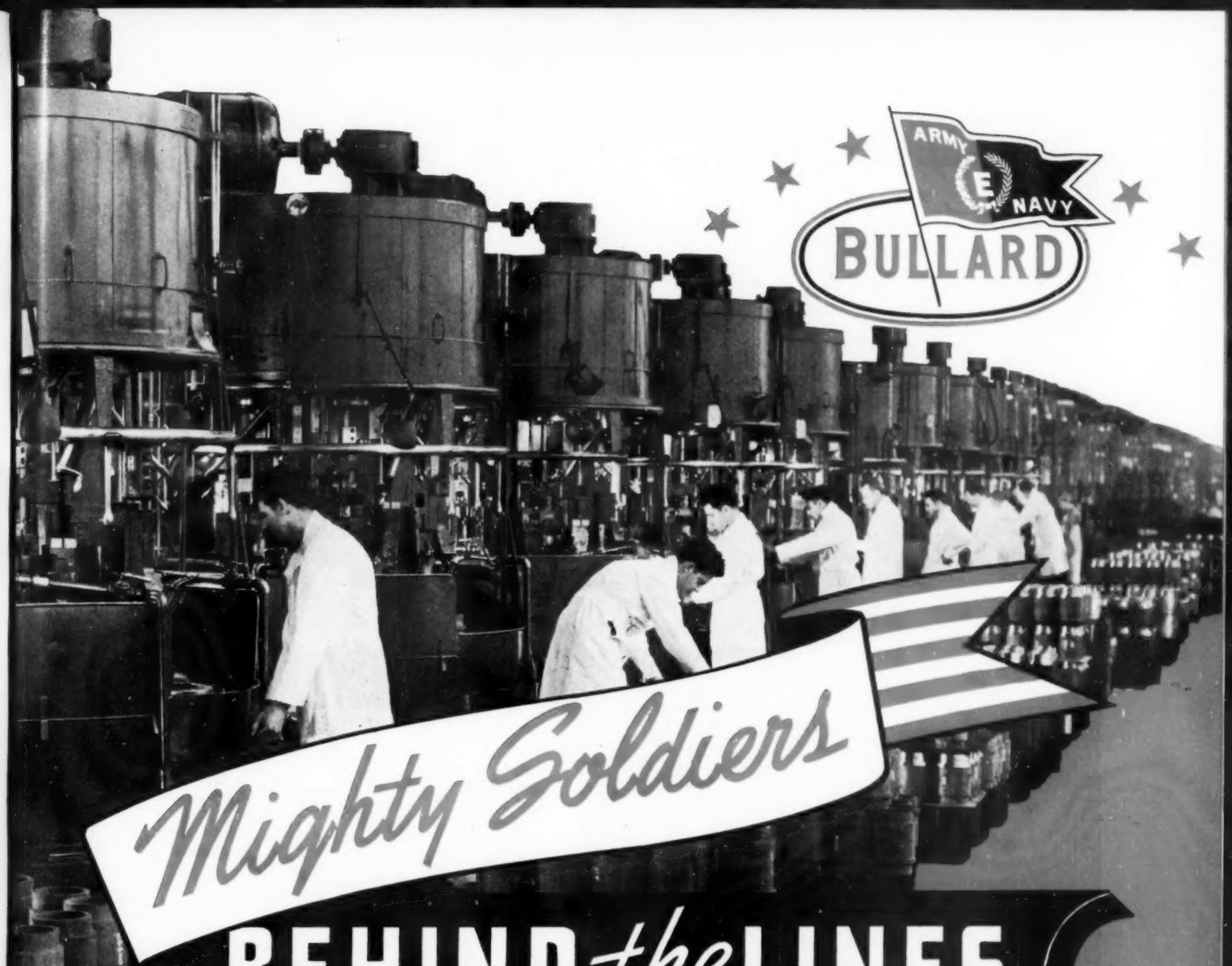
UNION
TWIST DRILL COMPANY
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass. Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

Representatives throughout the world

UNION



Mighty Soldiers BEHIND the LINES

● The Bullard Mult-Au-Matic was first conceived and used in the Automotive Industry nearly 30 years ago. From the start it applied a method of cost saving and speed of production which revolutionized machining processes.

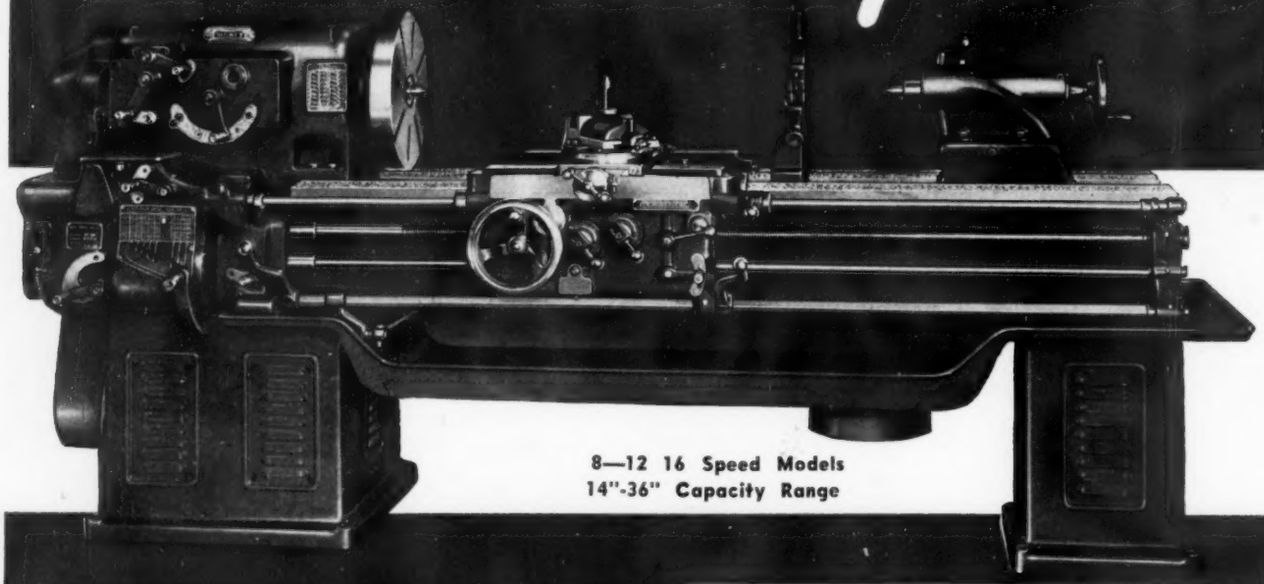
But not till the war was one of its biggest features fully utilized. Each machine could be quickly and easily converted to vital war production. In many cases Mult-Au-Matics have been retooled and changed-over to airplane engine work and other badly needed war equipment.

There are no Bullard Mult-Au-Matics "laid up" for the duration—and when the time comes to switch back to peace-time work, these machines will be quickly and easily changed-over to their new classes of work. Mult-Au-Matics are always all-out production machines—in all ways.

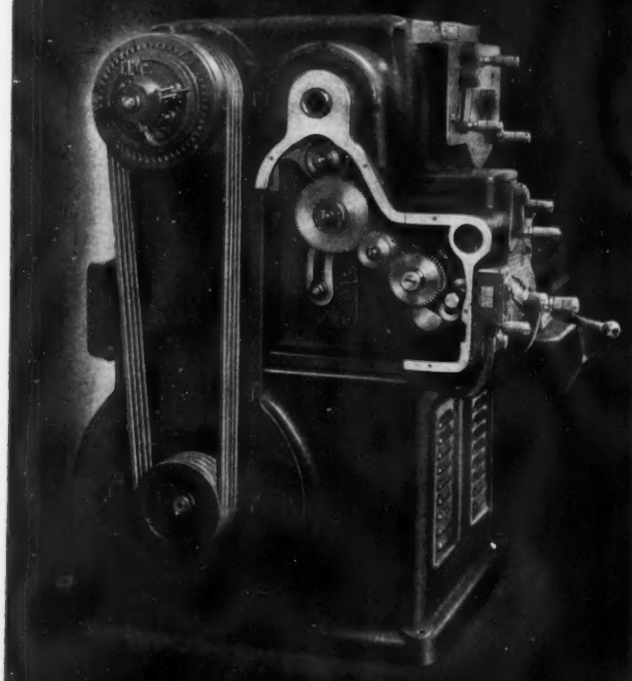
THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Smooth Flowing Power



8—12 16 Speed Models
14"-36" Capacity Range



Sidney Lathes

● The Accuracy and smooth finish essential to high production war work is assured by the smooth drive mechanism on Sidney Lathes.

The pulley, mounted on pre-loaded anti-friction bearings, is full floating on a sleeve bolted to the headstock to eliminate deflections of the drive-shaft because of belt pull.

The clutch is built for heavy duty service, is of toggle action type with single point adjustment. Clutch is equipped with gear tooth driving plates. The friction discs, back plates and floating plates are suitably finished to insure smooth, positive operation.

Thus you get a smooth drive with resultant smooth finish on the work.

Bulletins covering all models available at your request.

SIDNEY
THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.

The SIDNEY MACHINE TOOL Company
Builders of Precision Machinery
SIDNEY ESTABLISHED 1904 OHIO

STEEL SHELL CASINGS

A *CASE* FOR *HEAVIER* PRESSES

The Manufacturer of brass shell casings who is now being required to change over to the manufacture of **steel** casings will find that Power Presses of greater capacity are needed to successfully produce the new type.

We are prepared to furnish the proper equipment for making **steel** shell casings and our Engineering Department will be glad to submit practical recommendations of suitable machines for this purpose, to any Manufacturer interested in the production of casings made of **steel.**

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

CLEVELAND, OHIO

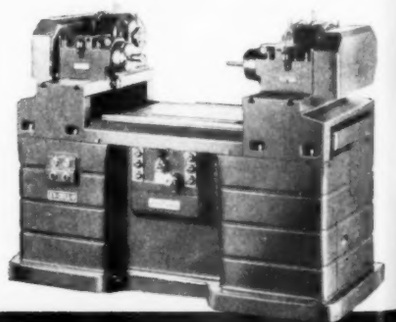
NEW YORK · DETROIT · PITTSBURGH · CHICAGO · PHILADELPHIA

WINNING THIS WAR IS EVERYBODY'S JOB

Thousands of new workers are pouring into factory doors to help produce the billions of dollars' worth of material vitally and immediately needed to win this war . . . sufficient long-experienced operators are just not available . . . it's a time when a modern type of standard machine tool like the Ex-Cell-O Precision Boring Machine can meet the emergency by doing a dual job: its easy control and automatic operating features make it possible to train ordinary operators in an exceptionally brief time to bore, turn, face, groove metal parts to the highest commercial standards of precision in size and finish, with a minimum of operator fatigue; this ease of operation, combined with basically sound engineering design and substantial, rigid construction for which all Ex-Cell-O machine tools are noted, *assures the extreme in production, every hour, every day.*

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

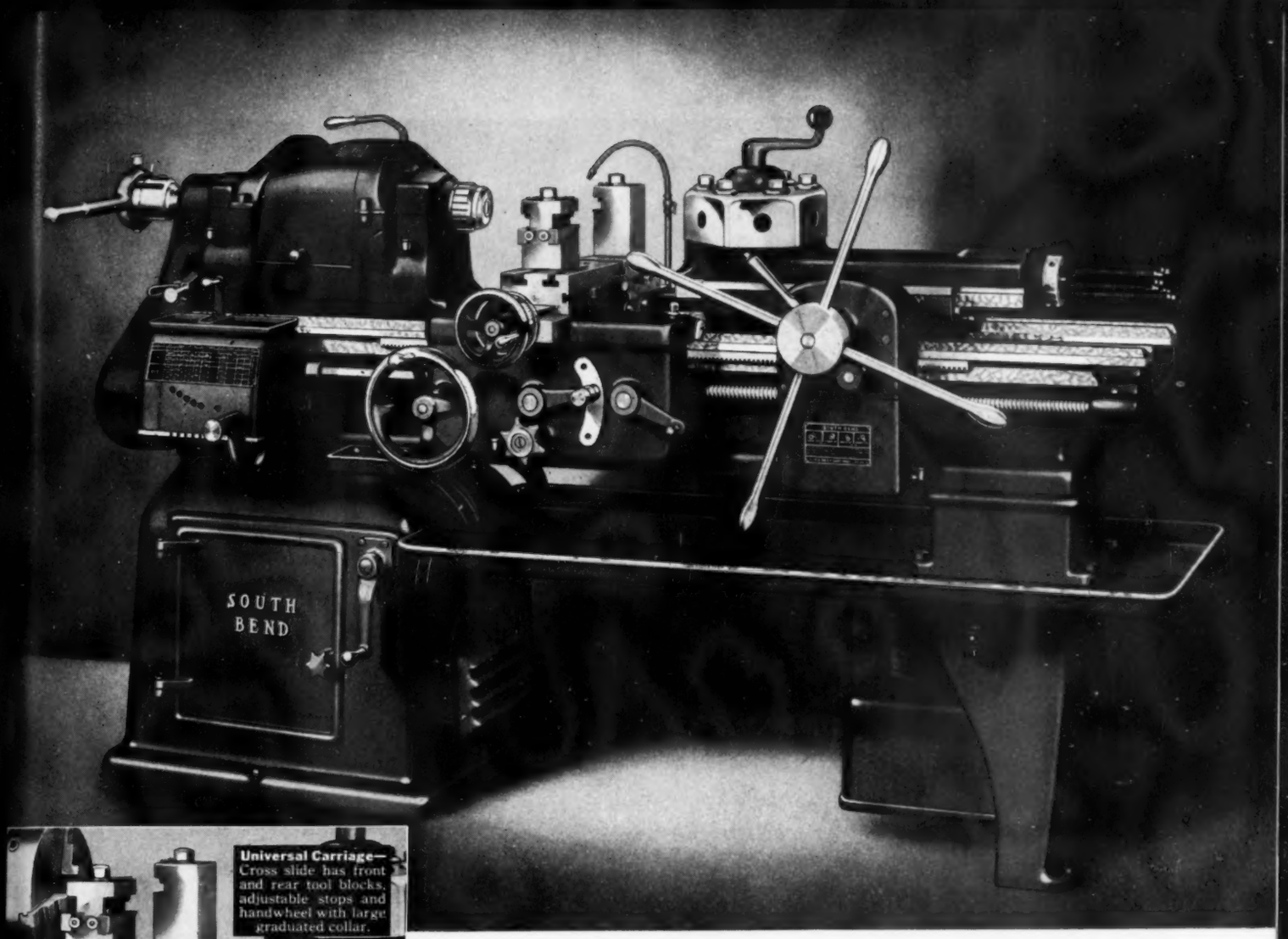
Below: Standard Double-End Ex-Cell-O *Precision* Boring Machine—used for many multiple and progressive operations, on the same part or various parts, to speed up war production.

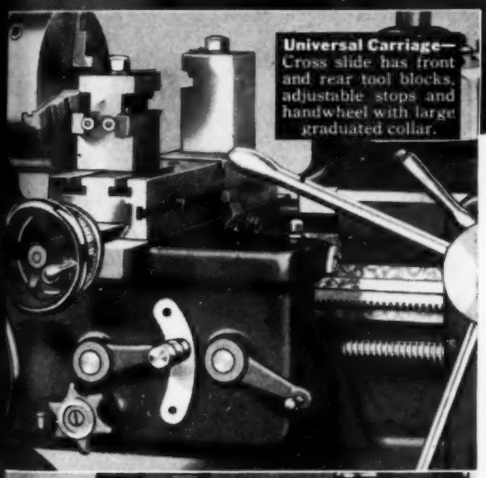


XLO

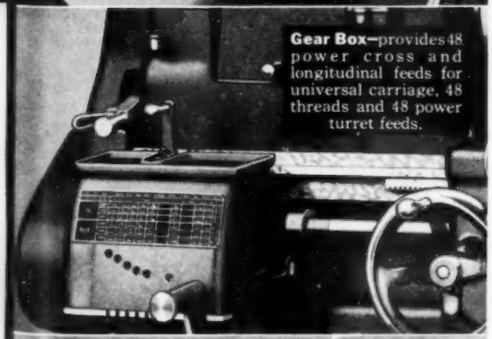
EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

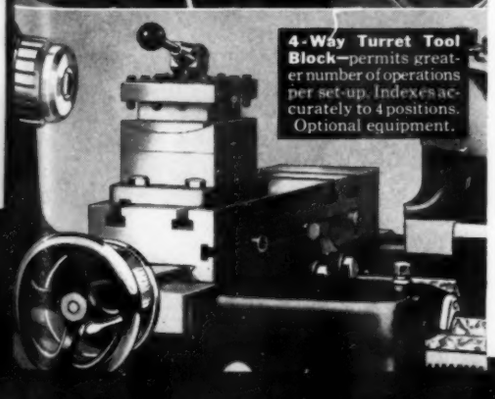




Universal Carriage—Cross slide has front and rear tool blocks, adjustable stops and handwheel with large graduated collar.



Gear Box—provides 48 power cross and longitudinal feeds for universal carriage, 48 threads and 48 power turret feeds.



4-Way Turret Tool Block—permits greater number of operations per set-up. Indexes accurately to 4 positions. Optional equipment.

SOUTH BEND TURRET LATHES

DESIGNED for the efficient production of duplicate parts, the South Bend No. 2-H Turret Lathe has the precision for exacting, close-tolerance operations—smooth power for producing a fine finish—versatility that reduces set-up time to a minimum.

The universal carriage has 48 power cross feeds, 48 power longitudinal feeds, and 48 thread cutting feeds ranging from 4 to 224 per inch. All changes are made through the quick change gear box at the headstock end of the lathe. Front and back tool blocks are supplied on the screw feed cross slide. A 4-way turret tool block is available to order. A large diameter micrometer graduated collar on the cross slide handwheel permits adjusting the cutting tools with extreme accuracy.

The ram-type turret has both power feed and hand feed, with an adjustable feed trip and stop for each of the six turret faces. The turret head indexes automatically on the return stroke of the turret slide. The quick change gear box provides 48 changes for power turret feeds. Change gears in turret apron provide an additional change for turret power feed, independent of tool post carriage feeds in both rate and direction.

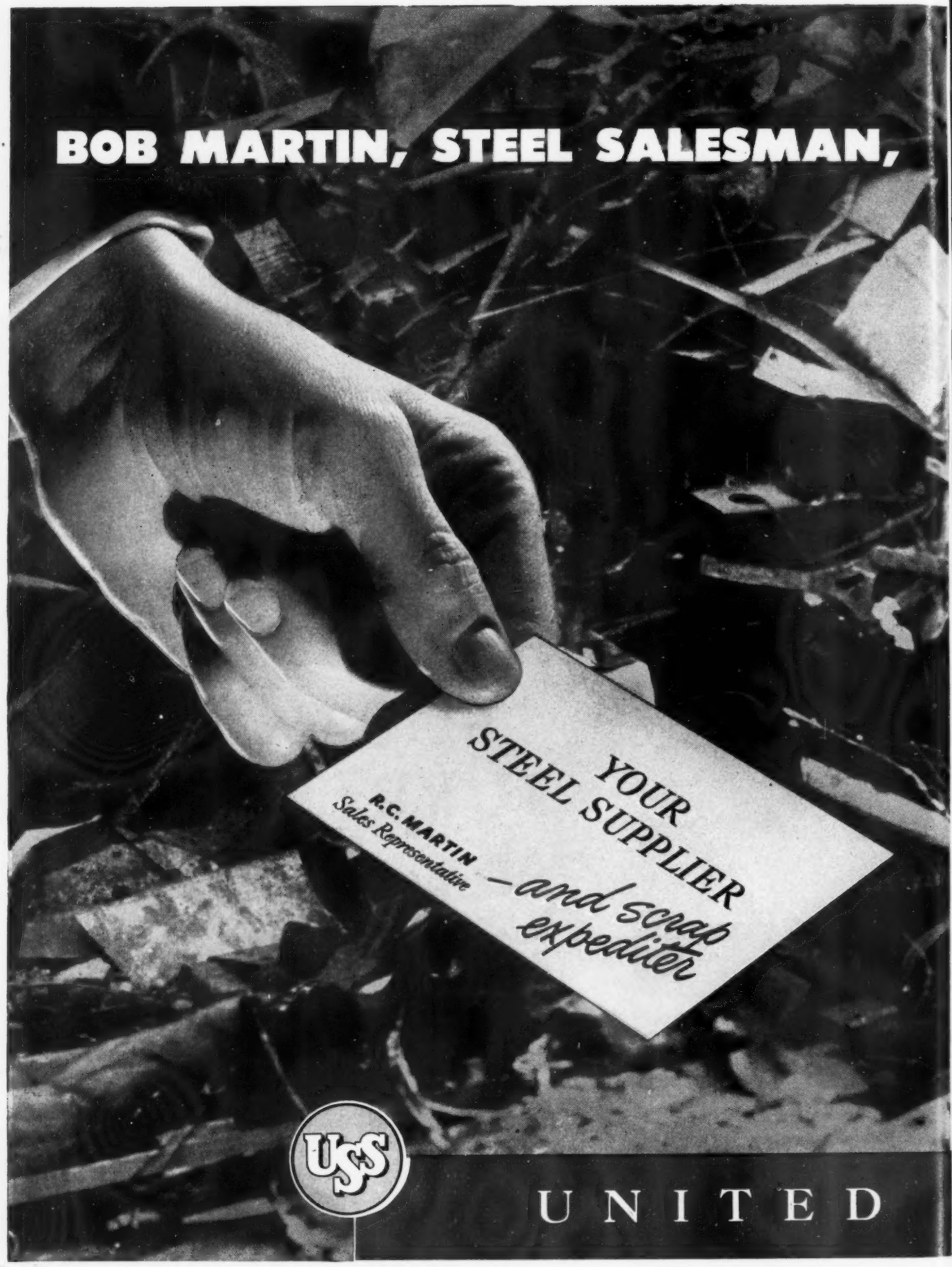
Full advantage can be taken of the higher cutting speeds possible with tungsten-carbide tools, as the result of the wide range of speeds and feeds available. The twelve spindle speeds range from 16 to 880 R.P.M. The use of a two-speed motor permits quick change from high to low speeds for reaming and tapping operations.

Investigate the possibilities of this new South Bend Turret Lathe—write for catalog and the name of our nearest dealer.

SOUTH BEND LATHE WORKS

Dept. 955, South Bend, Indiana, U. S. A.

LATHE BUILDERS FOR 35 YEARS


BOB MARTIN, STEEL SALESMAN,
YOUR STEEL SUPPLIER
R. C. MARTIN
Sales Representative
—and scrap expediter
USS
UNITED

IS NOW A *Scrap Expediter!*

American steel producers and steel warehouses are mobilizing their sales personnel to help you do a 100% job of getting in the scrap

WE'VE called him Bob Martin for short. He may be a U·S·S salesman, or he may represent some other steel supplier. In any case, it's his job to help you get the steel you need for war production when you need it. Things being what they are, that's a tough assignment in itself.

But now Bob Martin and many of his fellow salesmen have another war job. They've been made scrap expediters, too! The grave need for more scrap to produce more steel calls for unprecedented action. That's why the Steel Industry has joined forces with the War Production Board to make a thorough, continuous canvass of America's industrial scrap resources in the plants of steel consumers.

So don't be surprised if the next steel salesman who calls at your plant asks first how he can assist your scrap drive. His experience equips him to help you do the best possible salvage job. And he has been given special information by the WPB to make his efforts tie in closely with the Government's salvage program.

How a Steel Salesman Will Help to Expedite Your Scrap Drive.

On his new job as a scrap fieldman, in cooperation with the WPB, the steel salesman assigned to your plant will:

1. Call on a principal executive. Explain the WPB Dormant Scrap Drive objectives, and ask for your active and immediate cooperation.
2. Help, in doubtful cases, to identify dormant scrap, such as obsolete machinery, tools and equipment which are useless to war production because they are broken, worn out or not repairable.
3. Assist in facilitating the disposal of dormant scrap.

The need for scrap is URGENT! By December 31, 1942, an inventory of 7,000,000 tons must be made available to steel mills. Do *your* part by helping the steel salesman to do *his* part in this all-important drive.

HELP FOR YOUR SCRAP DRIVE

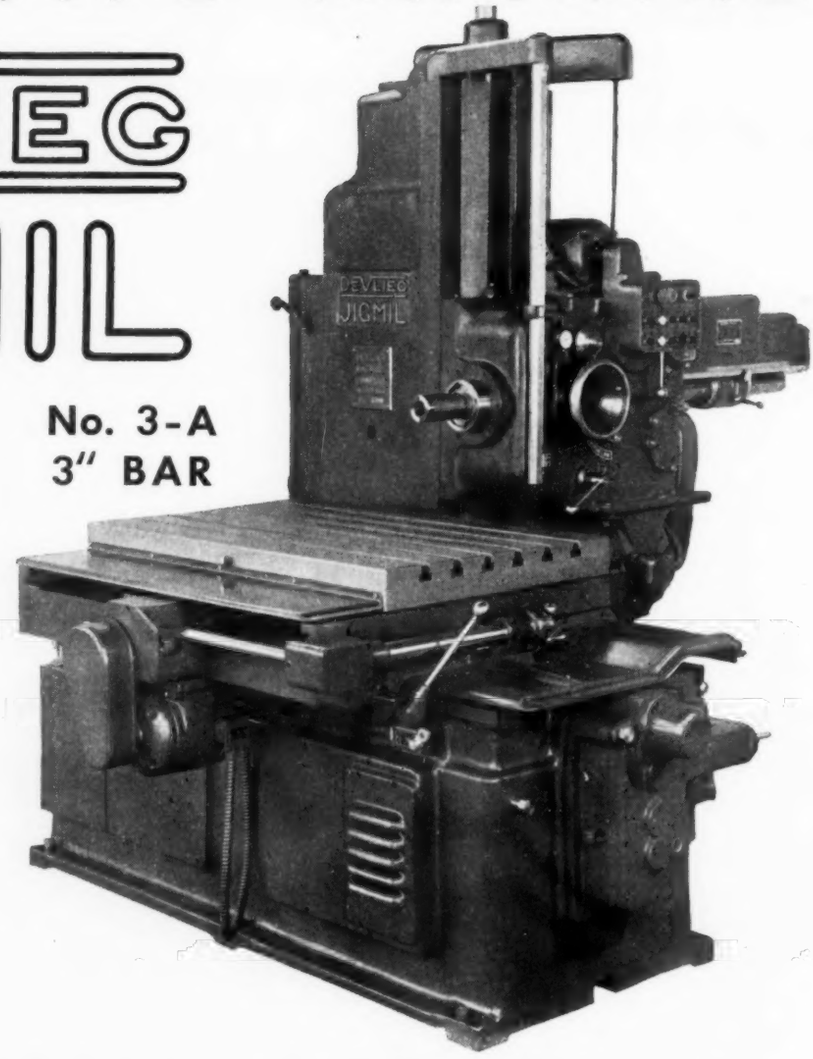
Inform your employees by showing the new sound slide film, "Let's Get in the Scrap." We'll be glad to lend you a print. Write to United States Steel Corporation, Room 1637, 436 Seventh Ave., Pittsburgh, Pennsylvania.

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York* • CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago* • COLUMBIA STEEL COMPANY, *San Francisco* • NATIONAL TUBE COMPANY, *Pittsburgh* • TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham* • SCULLY STEEL PRODUCTS COMPANY, *Chicago, Warehouse Distributors*

STATES STEEL

A NEW TYPE MACHINE

DEVLIEG JIGMIL



No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

• • •

THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

• • •

THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

☆ A PRECISION MACHINE ☆

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

Write for Circular

DEVLIEG MACHINE COMPANY
450 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

DEVLIEG MACHINE TOOLS

Tanks are Forgings

Tough, stress resistant forgings — parts that must withstand the most grueling punishment and service abuse — are essential in large quantities for the light, medium and heavy tanks now in production.

Because of the wider use of forgings, American-made tanks excel. They are faster, superior fighters, better able to withstand and "dish-out" blitz warfare.

Beating plow-shares into swords, making forgings for tank transmissions, engines, crawlers, guns and other operating parts is our daily job.

Ever more rough and finished parts of this type flow from under our hammers as the tempo of war production in our shops increases.

While our facilities today are heavily taxed, we still have the desire and the ability to serve more builders of tanks, ships, planes, guns, machine tools and ordnance.

A quick termination of totalitarian ambitions will speed the day when free men can follow normal pursuits. We are doing our part to help speed that day.

Proudly we fly the Navy "E" flag awarded for excellence and proficiency in the production of Naval Materiel.

KROPP FORGE COMPANY

Makers of Drop, Upset and Hammer Forgings for Guns, Planes, Tanks, Ships, Ordnance and Machine Tools

"World's Largest Job Forging Shop"

5301 W. ROOSEVELT ROAD, CHICAGO, ILL.

Representatives in Principal Cities

SERVING INDUSTRY SINCE 18 37 OVER 100 YEARS
K
KROPP FORGE CO.

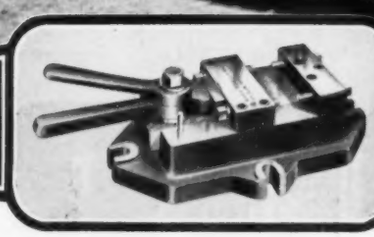
KROPP

IRRESISTIBLE POWER on the March

Fenn is working day and night to help provide parts that turn these war monsters into irresistible power. But tank parts are only a small part of the war production that passes through the Fenn Plant.

Fenn today presents a picture of a modern factory completely converted to producing essential material and equipment. The designing and building of special machinery - - Fenn's long-time specialty - - has been forgotten for the duration. But when war ends, *look to Fenn again.*

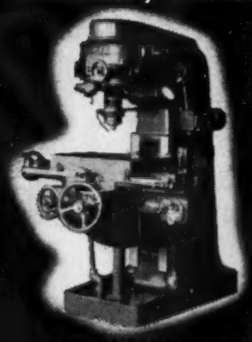
PHOTO BY U. S. ARMY SIGNAL CORPS



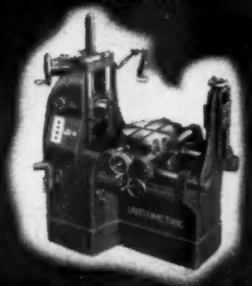
The Fenn Manufacturing Co.

HARTFORD, CONNECTICUT - - ESTABLISHED 1900

Machines, Accessories and Attachments for a Wide Variety of Needs:

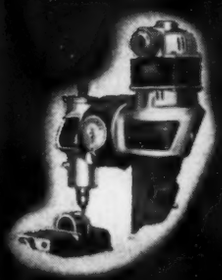


Rotary Head Milling Machine

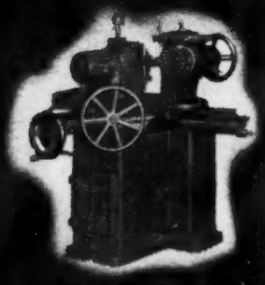


Autometric Jig Boring Machine

Milwaukee Midgetmill



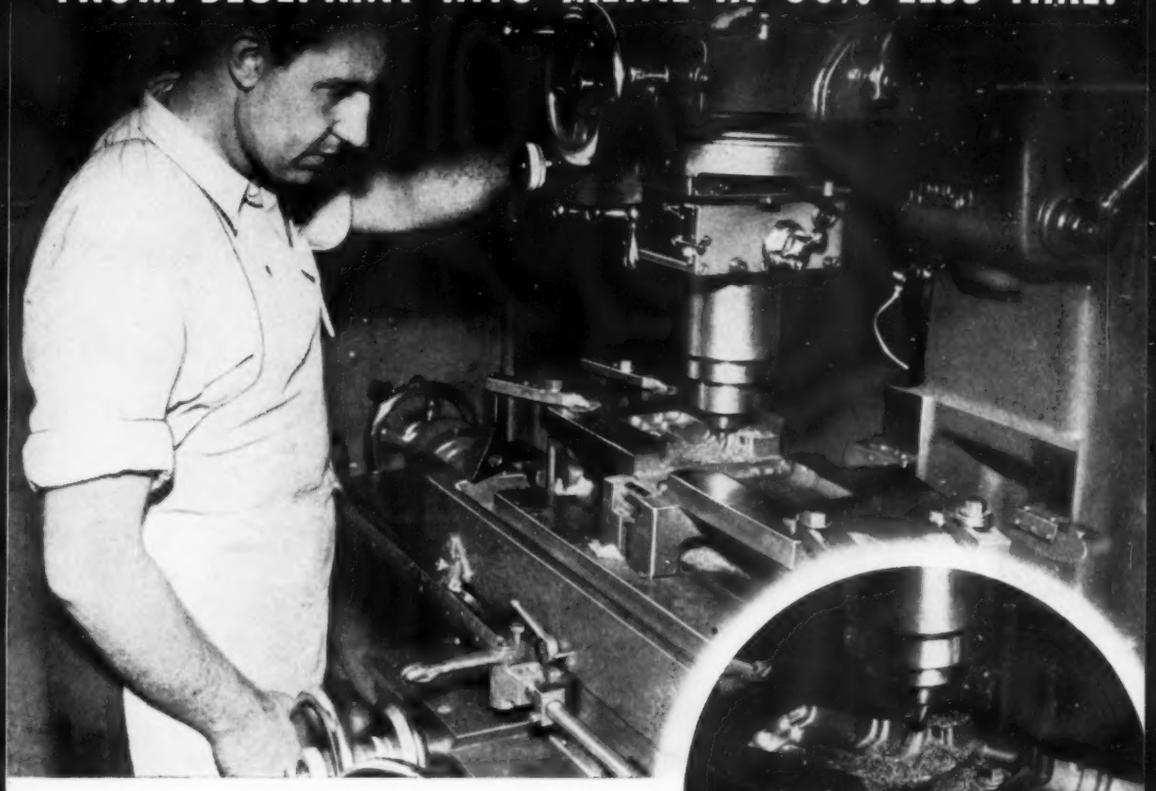
Milwaukee Speedmill



Milwaukee Face Mill Grinder

Center Scope

FROM BLUEPRINT INTO METAL IN 60% LESS TIME!



NO MODELS OR TEMPLETS NEEDED TO PRODUCE THIS PRECISION MOLD

The job illustrated above typifies the unusual performance of the Milwaukee Rotary Head Milling Machine. The permanent mold (cast iron) for aluminum shown above was produced in 60% less time than it previously required — without models or templets and directly from the blueprint into the metal.

The Milwaukee Rotary Head Milling Machine is without equal in the high speed, accurate, economical production of dies, molds, hobs, as well as the precision machining of many parts. In a single setup, it performs layout, milling, drilling, precision boring and slotting operations—mills circular and angular cuts in both vertical and horizontal planes.

* * *

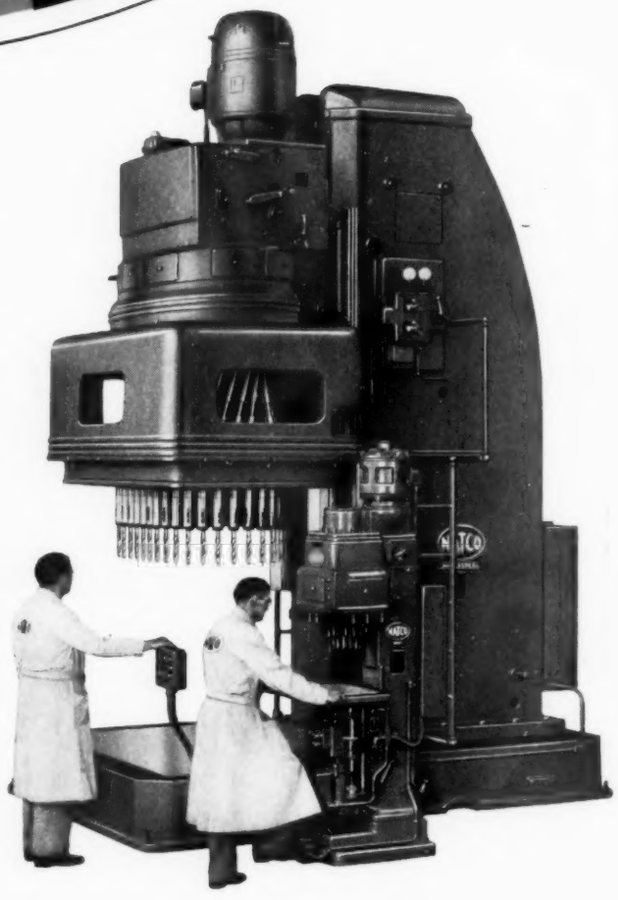
Send for Bulletin 1002 A, giving full information on the Milwaukee Rotary Head Milling Machine and its remarkable, low-cost performance.

KEARNEY & TRECKER PRODUCTS CORPORATION
Milwaukee, Wisconsin

Kearney & Trecker
Products
CORPORATION
Subsidiary of Kearney & Trecker Corporation

For excellence of performance in the production of machine tools, the NATIONAL AUTOMATIC TOOL CO., INC., has been awarded the ARMY-NAVY "E" BURGEE.

We at NATCO accept this honor as a challenge to better the ever increasing rate of production and to maintain our high standard of quality . . . a standard that has made NATCO a recognized leader in the machine tool industry.

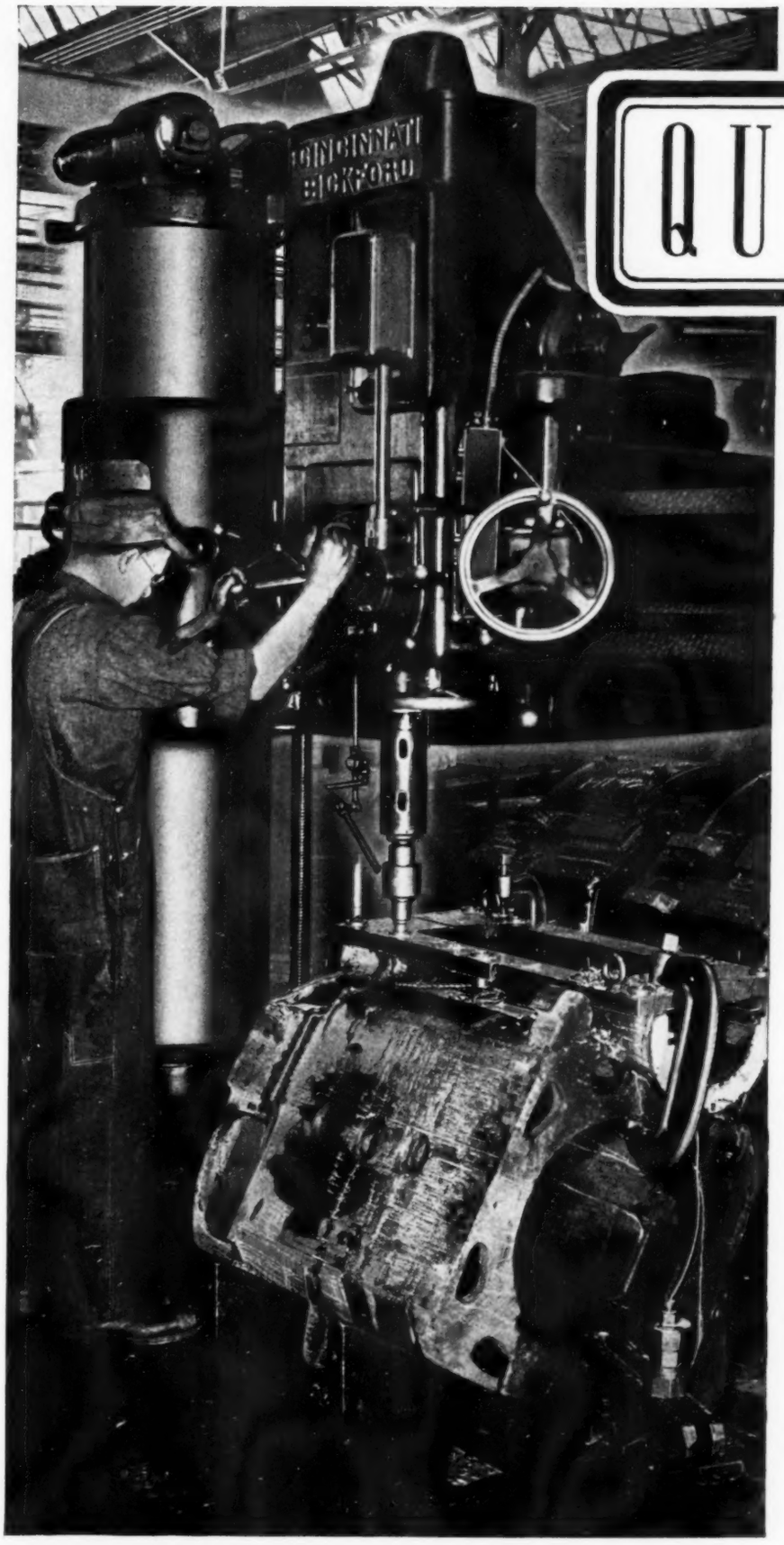


NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC.

RICHMOND, INDIANA, U. S. A.

DRILLING, BORING and TAPPING MACHINES



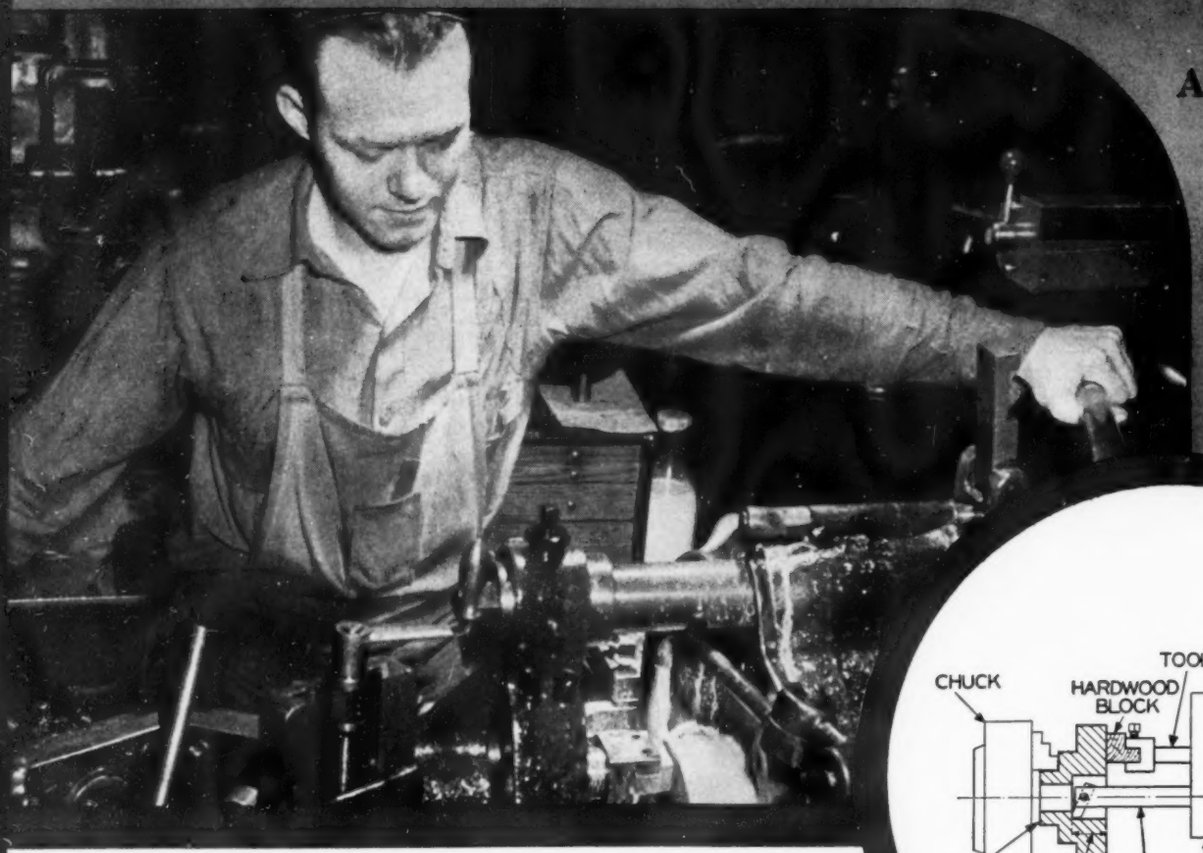
QUALITY

YOUR ONE SOLID ASSURANCE OF SPEED AND ACCURACY FOR **WAR** PRODUCTION

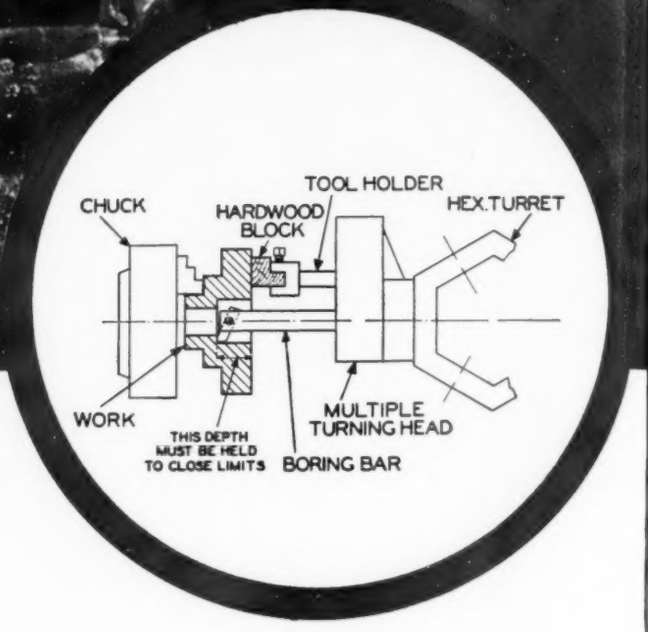
Illustrated is a typical application of the SUPER SERVICE RADIAL to wartime production. The job calls for operations on motor frames for Diesel-electric switcher-engines . . . vital jobs, because the War Department, the Navy Department, Arsenals and many large manufacturers require these engines to speed essential transportation. For work of this character the SUPER SERVICE RADIAL is almost a standard. You'll find these famous Radials on the job, 3-shifts-per-day, 7 days a week, in countless war production plants from coast to coast. The Quality of their design—the Quality of their workmanship and construction—the Quality of their performance is such that the name "Cincinnati Bickford" on a Radial is sufficient to assure top operating speeds, unexcelled accuracy and "more holes per dollar".

THE CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO, U. S. A.

Ideas for VICTORY from the Production Lines behind the Firing Lines . . .



A Citation for Men in War Industry



He Uses a Wood Block As a Simple Depth Limit Gauge!

Many operators are showing commendable initiative and resourcefulness in making the best use of the machines and tools they have at hand.

Such an operator is Raymond Brod. He runs an older model turret lathe at the Peters Machinery Company, Chicago. On some of his work it is necessary to hold close limits on the depth of a bored hole from a finished outside face on castings that vary in width.

The accompanying sketch shows how operator Brod uses a hard wood block, held in a tool holder mounted in a Multiple Turning Head, to act as a simple stop for the boring cutter. In recognition of his resourcefulness we are glad to send operator Brod a gold "Victory Pin."

Ideas that operators have found beneficial in saving time or producing better work are sent to us with the hope that they may help others. Many of these ideas are explained in Blue Chips, a bulletin of special interest to shop men, and sent free to the homes of turret lathe operators. Make sure your operators are on our mailing list to receive it. Write Warner & Swasey, Cleveland, O.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . .
WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

WENDELL E. WHIPP

THOMAS F. ROGAN

FRANK M. BATES

H. R. HAGEMAN

WOMEN AND THE WAR

More and more plants are finding it necessary to turn to women to fill the jobs vacated by men going into the services or created by expanding operations. Wendell E. Whipp, president, The Monarch Machine Tool Company, told the recent meeting of the National Machine Tool Builders Association the story of his company's experience in employing women. The experience of this firm should be of particular interest to anyone considering a similar step and so Mr. Whipp's account is included in this issue. Page 1213.

WAR-WINNING SUGGESTIONS

One of the primary aims of the War Production Drive has been to encourage workers to look for better ways of doing their job, to make suggestions for increasing production. Commendable suggestions now receive official recognition. Those that are considered best by local labor-management committees are sent to Washington. Several different awards are made for outstanding suggestions. The main purpose of the drive, however, is to get as widespread a distribution of practical ideas as possible. To this end, a group of the suggestions sent to War Production Drive headquarters in Washington is published in this issue. Page 1228.

TANK ENGINES

More than half of the machines used in the production of tank engines at Continental Motors Corporation have been converted from other work. Purchase of new machines has been kept to a minimum. Thomas F. Rogan, vice-president in charge of aircraft engine production at Continental, tells how this was accomplished. Page 1235.

CONVEYORS AVOID CRAMPING

One source of space that is often overlooked, when factory floors begin to grow crowded, is that up near the ceiling. Frank M. Bates, chief plant engineer, Fleetwings, Inc., tells how conveyors were used to take advantage of this space and condense manufacturing operations in the Fleetwings aircraft plant. Page 1244.

CENTRALIZED REBUILDING

Machine tools which have been badly worn and have been or are about to be discarded are rebuilt in a central shop at International Harvester. Since all of the various divisions use this centralized plant, it is possible to have the equipment necessary for a complete rehabilitation. Herbert E. Fleming describes the work of this plant in "Old Machines Rebuilt for War Work." Page 1224.

TINKERING WITH PATENTS

Several bills have been introduced in Congress that would basically change the function of the Patent Office, if passed. Among the changes they propose are compulsory licensing, unrestricted licensing and the cancellation of patents under certain conditions. The effect that these changes would have are described in an interview with Karl Fenning, chairman, National Committee on Patent Legislation, and Conway P. Coe, Commissioner of Patents. Page 1218.

CORRECT DIE SET DESIGN

Instead of making dies in the shop, it may be cheaper to purchase one of suitable design. The first of a series of articles by H. R. Hageman dealing with the maintenance of press tools is concerned with the selection of a design that will give a low first cost and economical maintenance. Page 1216.

INSIDE INSTRUMENTS

Gears which are used in instruments carry light loads but they must do so with an unusual degree of precision. Part III of the series on "Gears and Gear Cutting" discusses the application of bevel gears to this type of work. A. H. Candee, the Gleason Works, is the author. Page 1221.

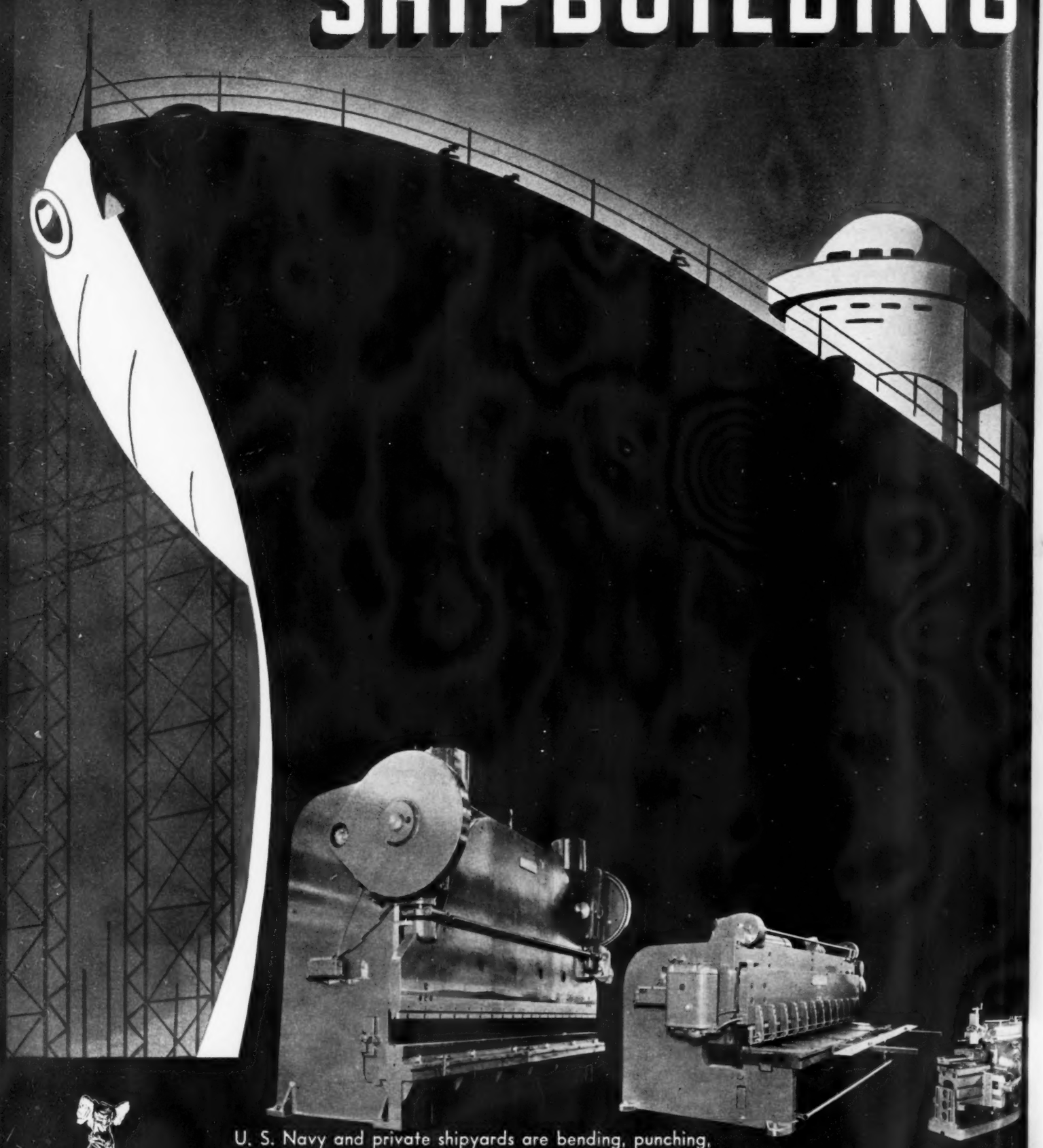
COMING

There are many cases where nonmetal die materials can be substituted for steel in making forming and bending dies for sheet-metal aircraft parts. The use of such dies has resulted in saving both time and critical material at the Naval Aircraft Factory. An article describing these dies will appear shortly.

Machining plastics requires special treatment. Plastics are poor conductors of heat and special care must be taken to avoid damage to the material. A series by John Sasso will describe the methods for machining and finishing plastics.

Dexterity tests used at the Republic Aviation Corporation help determine the ability of women to do various types of factory operations. Look for an article on these tests in an early issue.

SHIPBUILDING



U. S. Navy and private shipyards are bending, punching, and shearing plate on Cincinnati Press Brakes and Cincinnati Shears. Cincinnati Shapers are working aboard ships as well as in the yards.

Write for Recommendations

THE CINCINNATI SHAPER CO.

SHAPERS · SHEARS · BRAKES

CINCINNATI, OHIO.

A woman is instructed in the proper method of filing. Women frequently ask for suggestions as to how they can do their work better

How We Put Women to Work

BY WENDELL E. WHIPP, PRESIDENT, THE MONARCH MACHINE TOOL COMPANY

A plant which plans to employ women for machine operation and assembly must make plans carefully before hiring begins

THE MACHINE-TOOL industry has in normal times used very few women employees on machine production. In most plants the work has been considered more suitable to the physiques of men, and only recently has thought been given to employing women operators.

At Monarch we put off the actual employing of women just as long as we could—we didn't bring ourselves to do it until there were virtually no more employable men available. But for many months we thought about it and gathered as much information as we could so that as the time came nearer bringing women into the plant did not seem quite the revolutionary step it had always been considered.

Last March we went to three-shift, seven-day operations—and with that step we realized that we had reached the practical limit of available manpower in our area.

Among those women making application for employment was one in particular who showed unusual promise. She was a mature woman, with a background embracing considerable business and legal experience; and it occurred to us that we might well take her on, and use her as a laboratory experiment with the idea that she might act in the capacity of "Supervisor of Women" in case we later employed a large number of women in our plant.

The woman we thought eventually might be the "Supervisor of Women" in our shop went from department to department, trying out the jobs on a wide variety of machines, to find out whether a woman could perform them. She was successful with almost all of them. As a result of her personal experimentation on these different operations, we were convinced that in our plant women could successfully undertake almost any of the jobs which had been performed by men.

After the first of August women were added as rapidly as they could be absorbed. Today, out of the total

Below. Women have proved themselves able to handle all types of machine operations; the only differentiation so far has been made on a basis of physical effort

Left. Women excel in work requiring manual dexterity and speed. Below. About half of the women who have been employed at Monarch are on assembly work

factory force of 2,600, 300 are women.

On the first shift, which is the day shift, there are 95 women in the machine division. On the second shift there are 102 and on the third shift there are 103. These women are about equally divided between machine operation and assembly.

Generally speaking, the women in the older age brackets are assigned to the assembly division, and the younger women are used in the machine division because of their capacity to learn the operations rapidly and their dexterity in handling machines. Women are used to operate all types of machines with the exception of planers, heavy turret chucking lathes, and other heavy work.

They have proved themselves well able to handle all types of machining operations, and our only differentiation between men and women thus far has been entirely on the basis of degree of physical effort.

Women have shown themselves just as capable of learning how to operate machines as have the new men. In fact, with respect to some types of operations, they have shown themselves superior to men. They do particularly well in work requiring consistent care and alertness—in jobs where it is necessary to work to close tolerances, involving the use of gages, micrometers, and other checking equipment—but calling for little physical exertion.

Women also excel in work requiring manual dexterity and speed in repetitive movements. This is especially true in work which permits the operator to set her own tempo, and where she can work in a sitting position.

At the same time we are not sure that whether a woman sits down or stands up at the job makes any great difference. We have found that most of the women prefer to stand up at a job at which they might just as well sit on a stool.

Realize Their Importance

These women realize that in working in our plant they are helping to win the war. They are finding that a woman can help in this war just as well as a man, and they are determined to do their job just as well as a man could do it.

Our superintendents noticed a woman on an assembly job where it was necessary for her to lift a weight getting close to the 25-lb. limit prescribed by Ohio laws. He asked the foreman to change her to a lighter assembly job. The woman said:

"I'll work any place you put me, but I don't want you to get the idea that this job is too heavy for a woman. I'm no panty waist."

I cite this instance simply to show that as far as we can see, women are not asking for any discrimination or any special consideration because of their sex.

This is one of the reasons why we have adopted the wage policy we have with respect to women. The starting rate for women is five cents less per hour than the starting rate for men, with an automatic five-cent hourly-rate increase at the expiration of a 30-day probationary period. Women employees who have been through the six-weeks training course in the vocational department of our local schools start at the same wage as men, as do women going through our own vestibule training school.

In short, while it is necessary for psychological reasons, under some circumstances, to start women at a rate slightly lower than that under which men are started, we are operating on the principle that women are entitled to equal pay with men for equal work done; and this, we are convinced, is the only fair basis of compensation.

New girls are usually put to work in pairs, side by side in the same department. The supervisor of women introduces the girls to the foreman of the department, and paves the way for their acceptance in that department.

The girls feel that they can talk to

Girls take their jobs seriously and keep their eyes on their work rather than looking around

the supervisor of women on any personal matters which have to do with the feminine side of the picture—but they are definitely under the foreman.

The question of work costume seems to be one which has bothered many companies who have considered taking women into their employ. This has worked out very naturally, without any difficulty whatever. The girls adopted, more or less as the standard costume, slacks, a sleeveless shirt, bandana handkerchief, and the machinist's apron. There were variations in colors and styles, and each girl likes to get her hair done in whatever way she chooses, but on the whole, feminine costume conforms to a general type which is practical for the sort of work performed.

We once wondered what would be the effect on morale if we brought women into the shop. The net result has been to step up the morale of the entire organization.

The girls take their jobs seriously. They keep their eyes on their work instead of looking around the shop or grumbling about this or that. They frequently ask for suggestions as to how they can do their work better, and we get some valuable ideas from them.

To save floor space, our lathes are placed very close together with the work boxes at one end. This has meant that the operator had to step from the normal working position in front of the lathe to the end of the lathe in the course of the loading and unloading operation.

After a girl had been operating one of our lathes for several days, she asked the foreman if she could have a little stand on each side of her, so that she could operate the machine without taking a single unnecessary step. Here was an example of a woman applying in the plant exactly the same work-saving principles which she had learned in the kitchen. A man might not think about it—but a woman thinks about saving steps, and the result is increased output.

Two Vital Advance Steps

If you are going to employ women, don't get up to the dead-line without making preparations. There are two vital advance steps which must be made. The first has to do with toilets and rest room facilities. Entirely aside from obvious practical considerations, most states have laws dealing with toilets and rest room facilities for women. Plumbing equipment can't be ordered at the last minute. It takes time to get deliveries, so orders must be placed several weeks before you expect to have women start.

The other point is that you must have a reasonable, mature and experienced woman—capable of handling women's problems—on the job ahead of time. She should understand from personal experience the nature of the work to be done and the questions which will arise from the feminine viewpoint.

It is necessary therefore to obtain a woman of this type far in advance of the actual employment of large numbers of women. She should be brought in early—put through a course of training, with respect to the various operations involved—and made to understand that she is to function in the capacity of what you might call the "Dean of Women" for your organization.

Owing to development and design, the machine tool now does the physical work which formerly was done by the operator. The machine tool has within itself the precision and the power needed to get the job done. All that the operator has to do is to have the intelligence and the dexterity to operate the machine. It no longer takes muscle to be a machine tool operator. It takes a certain type of craftsmanship, which the younger generation have shown that they possess to a high degree.

It seems natural that girls should be able to learn this craftsmanship just as well and as rapidly as boys, and so make good machine operators.

Correct Designs Cut Costs

BY H. R. HAGEMAN

Blanking piercing and cut-off dies can often be placed on the press to permit sharpening without dismantling the set-up

FOR LOW FIRST COST and economical maintenance, the selection of a die set is of prime importance. Instead of making dies in the shop, it may be cheaper to purchase them. Manufacturers now list a variety of ready-made designs at low prices. They are obtainable with unbushed bearings, and can be used in place of plain holders for tools intended for limited production. Since they can be dismantled and re-used, and often prevent shearing and chipping likely to be caused by faulty set-up, they are well worth their cost.

Die sets having two guide posts set back of the mounting pad are suitable for follow-up or processing dies because the guide posts are always out of the operator's way. While they are not particularly efficient for aligning the members of a blanking die, they are frequently so used, even for blanking strip stock. With the guide posts so located, the die parts can be placed far enough from them to use a grinding wheel for keeping the die sharp without dismantling the set-up.

The die set shown in Fig. 1 is superior to the open front type for general efficiency. The rear post is shortened to pass under the spindle bearing of a grinding tool when a wheel of moderately large diameter is used. Also, all danger of the wheel striking the ram face is avoided.

Commercial die sets can be obtained which have the punch holder thicker than the die holder, or vice versa, to accommodate the design and maintain the predetermined shut height. When stripper or pressure-pad springs are to be used in the punch holder, that member should be thicker to allow space for adequate springs without excessive pre-loading. When springs are required both above and below the work, the lower ones can usually be suspended under the die holder, while if none are needed in the punch holder the die holder frequently can be thick enough to accommodate springs set in recesses. This avoids underslung springs, and provides a compact assembly for the press set-up, as well as for storage.

It is often advantageous to use thick punch holders in compound dies to avoid breakage. For example, if a thinner punch holder were used in the assembly shown in Fig. 2, and were bored out as deeply as shown, it would be weakened undesirably at the base of the shank.

Forming and bending dies, as well as compound blank and draw dies,

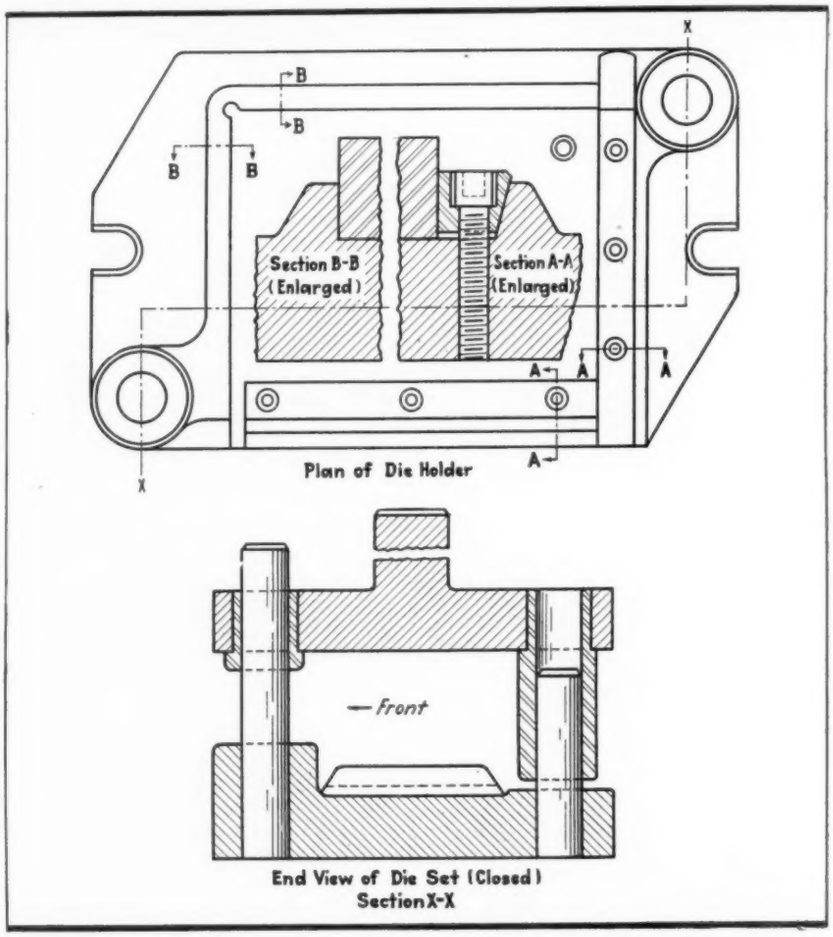


Fig. 1—This die set is superior to one of open-front design when it is necessary to sharpen the die with a moderately large grinding wheel. The rear guide post is shortened to pass under the spindle bearing of the grinder

should be located so that the area of greatest pressure is directly under the center of the press ram. This does not always apply for blanking, piercing, or cut-off dies—it is more important that these be located so they can be ground without removing their respective holders. When guide posts are used, clearance for grinding must be provided, except in the case of die sets such as shown in Fig. 1, where the rear post is shortened so it will pass under a grinding wheel spindle bearing.

Among the little things that help to keep down expenses incident to die maintenance is a definite system for locating and fastening punches and dies. The use of screws passing through both the stripper and die, and threaded in the die holder, as shown in Fig. 3, no doubt reduces the initial cost of the tool; however, it is the bane of the grinder hand and eventually proves expensive. When sectional dies are assembled in this manner, the dowel pins probably are expected to hold the steel down, but obviously they cannot do so after the sections have started to warp.

The grinding of dies has a tendency to curl them upward, making the underside convex and causing them to rock instead of being firmly seated. The greater the area of the steel and the thinner it becomes, the more it will curl. Frequently the die opening will close in on the cutting edge so much that the normal clearance is taken up and the punch is too tight in the die. The only apparent remedy for this situation is to have all four corners drawn firmly down by substantial screws, even though this requires a die larger than otherwise would be required. If an abrasion-resistant steel is used, which cannot be tapped readily, it may be necessary to sacrifice some of the life of the steel to avoid grinding the heads of screws inserted in counterbored holes as shown in Fig. 4. It is well to remember that when a badly warped die has been removed from its holder, it is almost impossible to replace it in the same position. Such dies should be left in place for their entire life.

The practice of using one tapped hole for two screws, as in fastening a die with a screw from the bottom and utilizing the same hole for a stripper screw, may seem profitable while the die is being designed. However, if the maximum service is to be expected from the die, it is evident that the screws will eventually become too short for practical use. In this case, the time and labor expended in tapping a few more holes would be more profitable.

Punch holders with drilled holes should be designed so that there is sufficient metal around the holes to prevent rupture, especially when they have center holes for knock-out pins. Holes in the shank can be avoided by employing the designs shown in Figs. 5 and 6.

Part 2 of this article will appear in an early number.

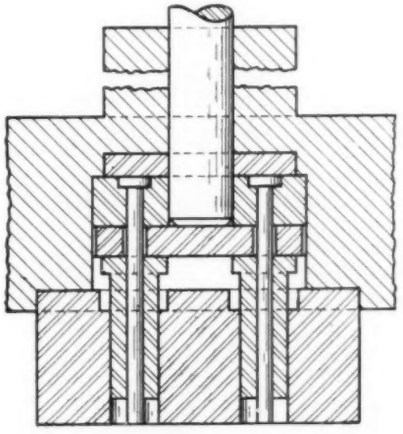


Fig. 2—It is often desirable to use a thick punch holder in compound dies. If a thinner punch holder were bored out as deeply as shown here, it would be weakened at the base of the shank, and probably result in early breakage

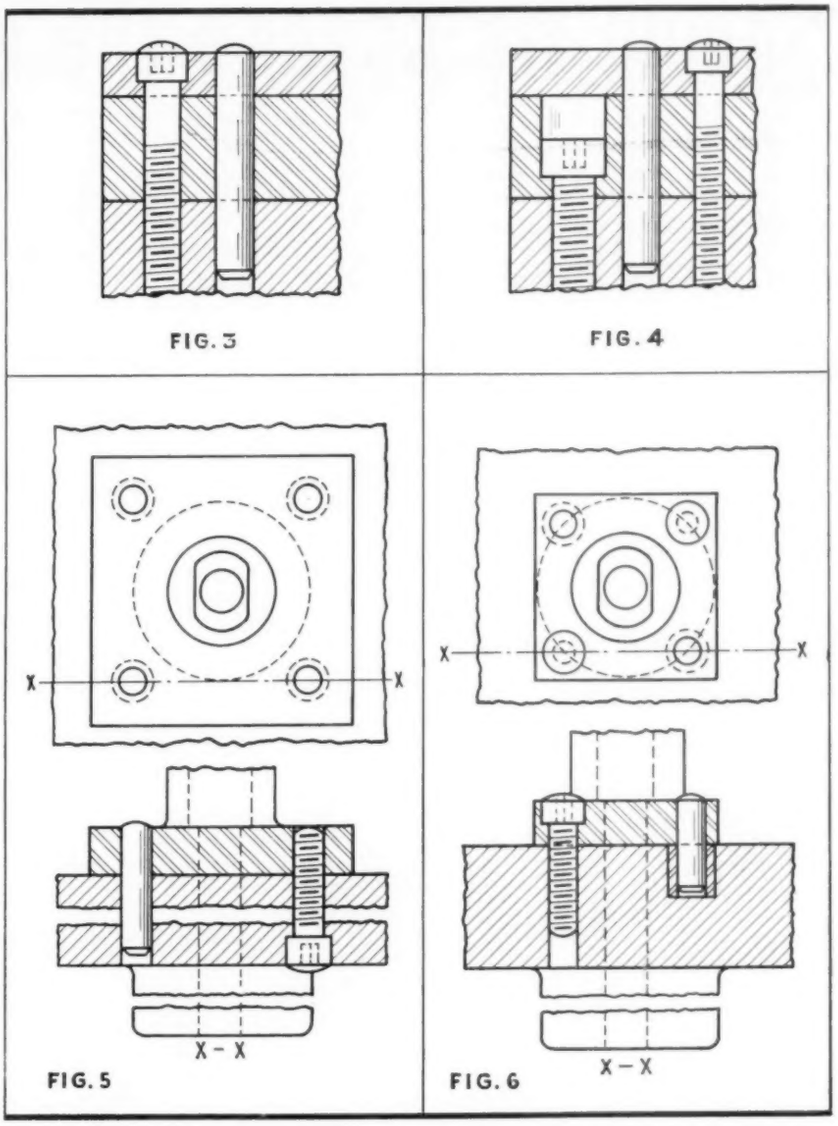


Fig. 3—The practice of fastening steel in the manner shown here may reduce the initial cost of the die, but will not always prevent the part from warping. Fig. 4—The life of dies which must be sharpened regularly can be increased by holding the corners down with substantial screws. Figs. 5 and 6—Holes in the shanks of punch holders can be avoided by employing these designs. Holes drilled too close to the knock-out pin hole may cause early rupture of the shank

Should We Change the Patent Law?

A basic dispute over patents is whether they are property rights or merely a cancellable franchise from the government

BECAUSE of his position as Assistant Attorney General of the United States, his dramatic handling of situations and his undoubted flair for publicity, Thurman W. Arnold has occupied the center of the stage in the current patent controversy.

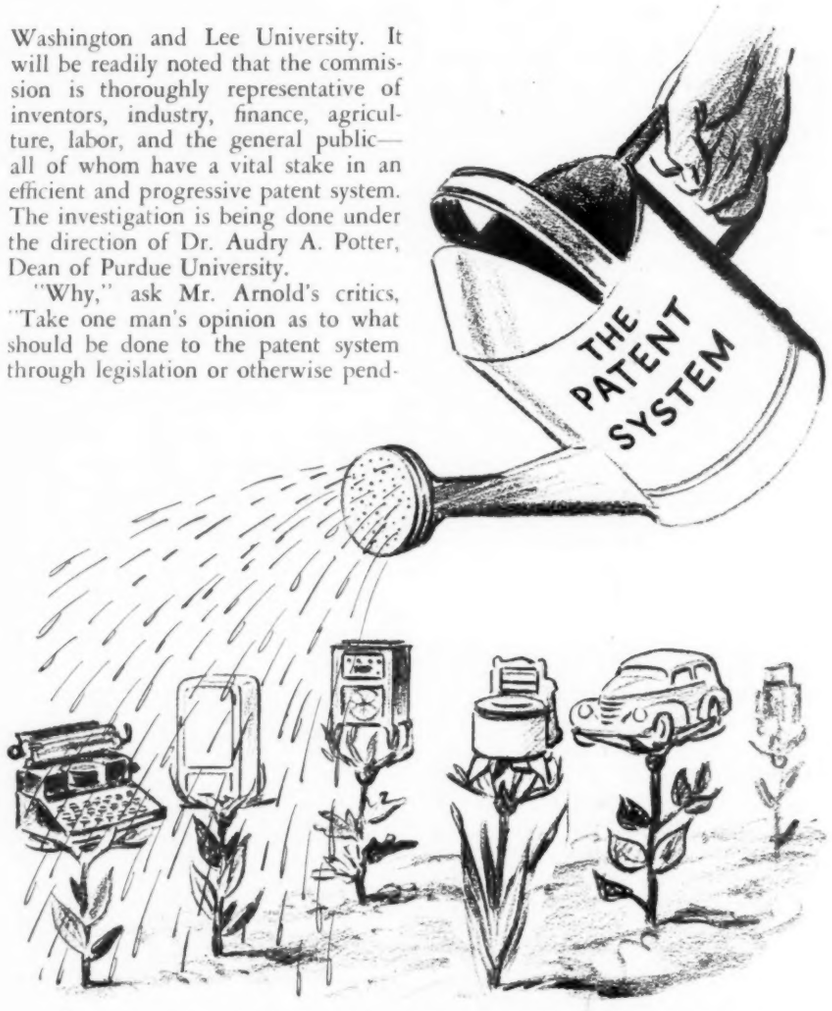
This does not mean, however, that he has the stage to himself nor that he has won the battle. Against him and his theories of patent law reform are almost solidly aligned the leaders of patent law in America, the leaders of industry and many of the outstanding pioneers in the field of modern American invention.

This group is strongly opposed to hasty legal reforms on the ground that such reforms might well undermine the patent system itself and at the same time place a heavy discount on inventive genius for the future by depriving the patentee of the rewards accruing from patents or by discouraging financial aid for the commercial development and proper exploitation of patents.

Against hasty action one argument in particular is forcefully advanced, namely that no general overhauling of the patent system should be undertaken until the Patent Planning Commission established by President Roosevelt on December 12, 1941, has submitted its report under the comprehensive directive of the Chief Executive. The report of the commission will take cognizance of post-war conditions as regards the position of American industry and inter-related patent problems—national and international. This last consideration alone, it is contended, should preclude any piecemeal tinkering with the patent structure at this time.

The commission is composed of the following: Dr. Charles F. Kettering, chairman, vice president of the General Motors Corporation and chairman of the National Inventor's Council; Owen D. Young, former chairman of the board of General Electric Company; Chester C. Davis; Edward F. McGrady, former Secretary of Labor; and Charles P. Gaines, president of Washington and Lee University. It will be readily noted that the commission is thoroughly representative of inventors, industry, finance, agriculture, labor, and the general public—all of whom have a vital stake in an efficient and progressive patent system. The investigation is being done under the direction of Dr. Audry A. Potter, Dean of Purdue University.

"Why," ask Mr. Arnold's critics, "Take one man's opinion as to what should be done to the patent system through legislation or otherwise pending the considered findings of this distinguished group?"



". . . patent protection is a basic requirement in order to secure to the public the commercial development accruing from patents."

Mr. Arnold, however, has refused to wait. Bills that would radically change the patent structure are now pending before Congress and several, including three of the most important of them, bear the imprint of the Assistant Attorney General and his colleagues in the Antitrust Division of the Department of Justice. It is significant that neither the Department of Commerce, which is charged with the welfare of industry, nor the patent office are in any way connected with the major pending legislative proposals. One of these is a war measure designed to enable the government to use all patents for the effective conduct of war industry. The need for even such an amendment to the existing law is far from being generally accepted, since it is contended that under the war powers and under specific enactments by former Congresses, the government can use all patents. Two of the pending bills, however, are of a permanent nature and it is around them and the drastic changes they contemplate that the main controversy rages. One of the bills in question proposes compulsory licensing and unrestricted licensing, both features to be retroactive as regards patents heretofore granted, and all rights and arrangements made under them. The other measure, it is contended, would virtually establish Mr. Arnold, or whoever should happen to head the Antitrust Division of the Department of Justice, as a Czar over the entire patent structure in the United States,

making the division a party to all infringement suits and calling for the cancellation of patents under conditions set forth in the bill. This provision of cancellation of patent rights is of the greatest importance because it is in line with Mr. Arnold's pet theory that a patent is a franchise issued by government and subject to revocation rather than a property right protected by constitutional guarantees.

Action on the body of proposed legislation is temporarily suspended, but it is the confirmed opinion of the opponents of Mr. Arnold's reform theories that there is enough dynamite in the proposed legislation to shake the patent system to its very foundations.

The all-important consideration at the moment in the opinion of Conway P. Coe, U. S. Commissioner of Patents, is not the amendment of patent laws but the effective use of patents for the prosecution of the war, the encouragement of new patents, and the preservation of the present structure for the future benefit of the country. Commissioner Coe has this to say: "Patents are both the incentive and the reward of invention. In its turn, invention is the stimulus to material progress, as the framers of the Constitution intended it should be. Down through fifteen decades the millions of our people have benefited by the inspiration and protection they have afforded to the inventors whose genius has given the United States industrial preeminence and preponderance. Every section of our population and every region of our country has profited by the products of our inventors.

"Inventions are more indispensible in this crisis of war than they have been in the decades of peace. They are meeting the daily needs of manufacture, agriculture, commerce, transportation and communication. They are vital to our armament on land, at sea and in the air, at home and abroad, that we may defeat our enemies and preserve our independence and our liberties. We are now fighting our foes with hundreds of American inventions. Others are coming to us daily from the minds of American inventors who are spurred by patriotism and recompensed by patents.

"The lesson taught by these historic facts is that we should be thankful for the system that has done so much for us in peace and that assures to us still more in war. And our gratitude should prompt the preservation of that system for the future."

"Repeated elaborate investigations have failed to reveal even a single unfair suppression of patented invention."

One of the best known patent authorities in the United States, Karl Fenning, former assistant commissioner of patents, feels very much the same way as does Mr. Coe on the inadvisability of experimentation or innovations at this time.

"Before endeavoring," said he, "to determine what if any changes or controls should be placed on patents it is necessary to determine what economic system or theory is to be the basis of our industry after the war. If we are to have a regimented industry we may need cartels such as Germany has and so we may adopt from the German patent law compulsory licenses which are being advocated. If not, it seems unnecessary to copy Germany in that or any other respects. Probably compulsory licenses under United States patents will be unconstitutional.

What of the Inventor

The fate of the inventor under some of the reforms advanced, such for example as withdrawal or cancellation of patent rights and the subsequent scaring away of capital is causing considerable apprehension. In a recent study made by the National Association of Manufacturers, it was shown that out of 712 inventors, lack of financial support was found to be the inventor's greatest obstacle.

"In general," said Mr. Fenning, "our present patent laws are admirably adapted to encourage the poor man who has invented something entirely new to benefit the public. The occasional improper use should not cause a fundamental change from the constitutional "exclusive right" granted the inventor. He should be free to deal with his invention as he thinks best without governmental contact—even by getting the Department of Justice to approve in advance his business arrangements.

"The best way to incite to invention is to show a need for invention. When something new is developed and patented every competitor wants to enter the same field. If the patent is strong and closely held, the competitor must produce an invention of his own to compete, but if he can get a compulsory license there is no incentive to invent a competing device. Thus when one method of producing magnesium was patented another method of producing magnesium was invented and magnesium is now being produced by both methods.

"No one will invest the needed time, work and capital in developing

a new invention if the patent is hedged in so as to give no protection, and even then is subject to cancellation if it protects the new infant industry. Dr. Alexander Graham Bell, the inventor of the telephone, in commenting on the Stanley bill proposing compulsory licensing, stated in a letter of April 12, 1922, that:

> 'It is almost too obvious for comment that the existence of such a law would make it practically impossible for the inventor to obtain capital. I cannot think of anything more effectively designed for the discouragement of inventive genius.'

Commissioner Coe feels that patent protection is a basic requirement in order to secure to the public the commercial development accruing from patents. "Speculative capital," he said, "will not back new inventions without patent protection."

Even more positive was the danger signal recently hoisted by S. Chesterfield Oppenheim, Professor of Law, George Washington University. "While abolition of the patent system is really not in issue," said Professor Oppenheim, "there is nevertheless danger that in the zeal for ridding the system of evils the rewards of the patent will be whittled away to the point of seriously impairing incentives to invent and causing a flight of capital from inventions inadequately protected by law in the initial stage of commercial development."

Subsidized Research Opposed

Subsidization of research by government, which Mr. Arnold favors, will never take the place of the large number of individual inventors, working on their own through years of experimentation in out of the way places—the Ketterings, the Edisons, the Bells and a host of other lesser knowns. Mr. Fenning contends: "There is no need of subsidized government research facilities as long as the law continues to give patents strong enough to protect speculative money invested in patent inventions."

Mr. Fenning does not hold at all with the view so frequently expressed by Mr. Arnold to the effect that patents have been withheld from use, thereby curtailing the production and distribution of consumer goods and commodities. "Repeated elaborate investigations," said he, "have failed to reveal even a single unfair suppression of patented invention. Despite many allegations to the contrary, no one has ever been able to show a single instance. It is a most serious charge constantly recurring against patent owners, the idea being that an important invention is suppressed because it might adversely affect the profits of the current device or method. The myth of the alleged carburetor that would secure 75 miles per gallon of gas being suppressed by the automobile and gasoline companies is typical. The Oldfield hearings in 1812, the Stanley hearings in 1922, the McFarlane hearings in 1938, and the Temporary Economic Committee in 1939 pursued the subject with vigor without finding a single instance of such suppression. This alleged suppression of patents is a basic argument used by advocates of compulsory licensing of patents. The interest of the patent owner lies in the direction of using any invention that really accomplishes its purpose more satisfactorily than the existing art, and this is the obvious reason why suppression of patents cannot be found."

Abuses Outside Patent Law

The bitterest opponents of Mr. Arnold's patent reform schemes freely admit that patents have from time to time been abused, for the most part in connection with commercial combinations in restraint of trade and in furtherance of monopoly violating the Antitrust laws. They point out, however, that this only happened when patent holders acted outside the rights conferred upon them by the patent and that it is not in any sense a manifestation of an economic evil that adheres in the patent system or in the nature of the patent itself. They further contend that the reforms have made a "whipping boy" of patents before the bar of public opinion and distorted the picture out of all proportion to the number of cases of patent abuse on the basis of court decisions. Such abuses, they aver, have been and can be corrected through the established legal procedures under the Antitrust laws.

In a recent address, Senator Wallace White of Maine, a member of the Senate Patents Committee, pointed to the great danger of confusing the patent with the occasional abuse of the patent. Such abuse, he contended in effect does not any more invalidate a patent than it would invalidate rights in any form of property. He proceeded to quote from a decision of the late Chief Justice Taft as follows: "It is only when he (the patent holder) adopts a combination with others by which he steps out of the scope of his patent rights and seeks to control and restrain those to whom he has sold his patented articles in the subsequent distribution of what is theirs that he comes within the operation of the Antitrust Act."

"It seems to be admitted," said Mr. Fenning, "that proper enforcement of the present Antitrust laws would prevent what are called abuses of patents. Cartels are prohibited by the Sherman Act and the Clayton Act and the Department of Justice can bring suits to prevent improper uses of patents. Certainly cancellation of patents is not necessary since the courts now refuse to enforce patents which are used as bases for improper restraint of trade."

In building up for the public the picture of patents as so many wolves masquerading in sheep's clothing, much has been made by Mr. Arnold and his associates of the alleged handicaps resulting from the relations of American industries with foreign cartels. On this much exploited subject, Mr. Fenning has this to say, "We can get the information from patents issued in foreign countries and foreign influence in our industries might be avoided by refusing patents to foreigners for inventions patented abroad. However, this would inevitably result in the refusal of foreign countries to grant patents to citizens of the United States. The tendency would be to promote secrecy rather than beneficial disclosure of patents. The inventive product being the creation of something that never before existed and that adds to the sum of human knowledge, it is again emphasized that a patent takes nothing from the public that was previously enjoyed and that the short period of exclusive use granted to the patentee is only a reasonable reward for the inventor's contribution."

Slow Start, Fast Finish

Some ideas develop slowly, others seem to attain popularity in short order. The honing of cylinders is one of the latter. Hydraulic mechanisms for driving machines and for feeding came slowly, but they have definitely arrived.

Those who knew the old Jones & Lamson shop in the early days of the flat turret, will recall the lathe that James Hartness fitted with a hydraulic feed. That was one of the many devices that cropped out of his inventive mind.

Dan Wright too had the hydraulic idea many years ago. His was a very comprehensive plan for driving the machines as well as providing the feeds. He proposed a central pumping system with pipes to every machine in the shop for driving hydraulic motors in each lathe or other machine tool. He had the individual motor drive idea before we had developed the electrical system of power distribution.

Dan would be pleased, if not surprised, to see how rapidly hydraulics have come into the machine tool field during the last few years.

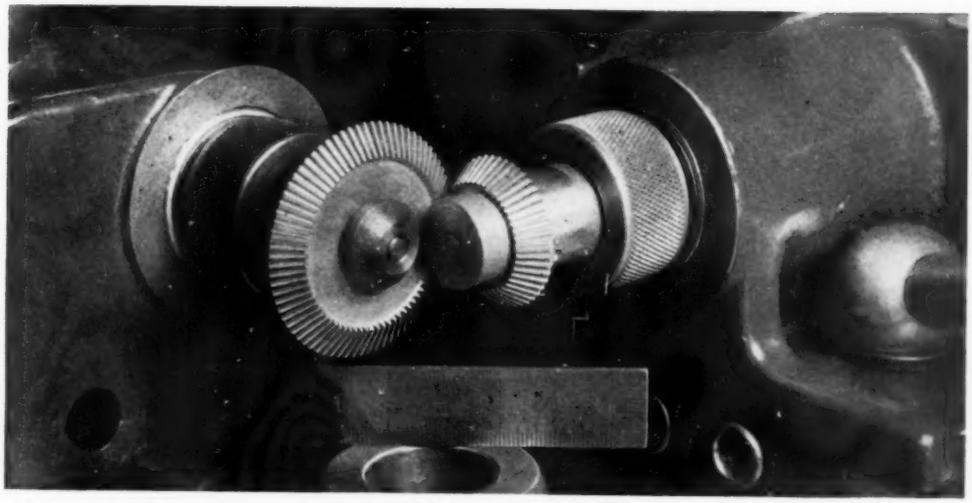


Fig. 25—Small bevel gears of extreme accuracy are being required in instruments

Gears and Gear Cutting

BY ALLAN H. CANDEE, GLEASON WORKS

III—War production has created a demand for "instrument" gears, carrying light loads with an unusual degree of precision

AT THE PRESENT TIME a great expansion is taking place in the manufacture of instruments of one kind and another for aircraft control, gun sighting, searchlight control, automatic calculating devices, etc. Most of these use small accurate gears, which are being demanded in large quantities. The gear industry refers to them as instrument gears, meaning that they are small and lightly loaded, but of the highest possible degree of precision.

Fig. 25 shows small straight bevel gears belonging in this classification. They have to pass extreme tests for accuracy in all respects. It is often desired that instrument gears operate with little or even no backlash and with the utmost smoothness of motion. Such requirements necessitate extreme care from beginning to end of manufacture.

A particularly useful feature in bevel gears is that because of their conical form the backlash can be closely controlled by adjusting the gears along their axes. In gears with parallel axes the only ways to vary backlash are to change the center distance or to change tooth thickness. With bevel gears, however, Fig. 26 shows how in the design of shafts and mountings it is easy to use spacing washers which can be made or selected of just the right thickness in the assembling operation to leave the desired backlash in the gear teeth.

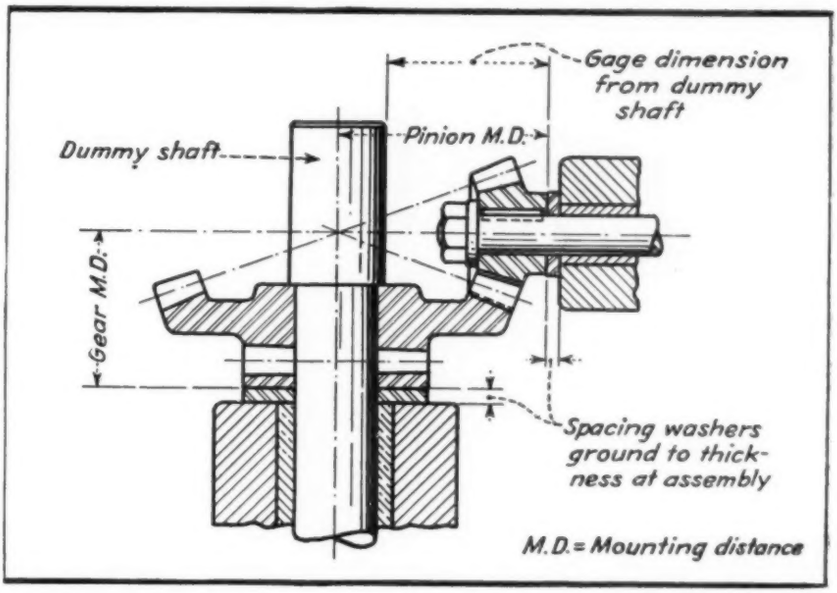


Fig. 26—Backlash can be varied by adjusting the relative position

This feature is especially valuable in differential or planetary gear arrangements, in which pinions may be assembled with gears on two sides. It is then impossible to make changes of center distance, and in the case of spur gears the backlash will vary with tooth thickness, it of course being impossible to manufacture gears or other parts with-

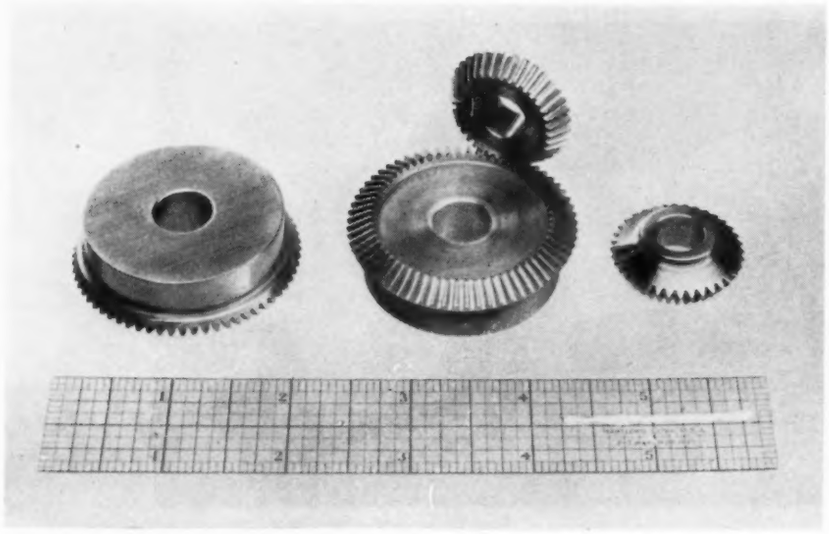


Fig. 27—Spiral bevel and Zerol teeth can be ground after hardening

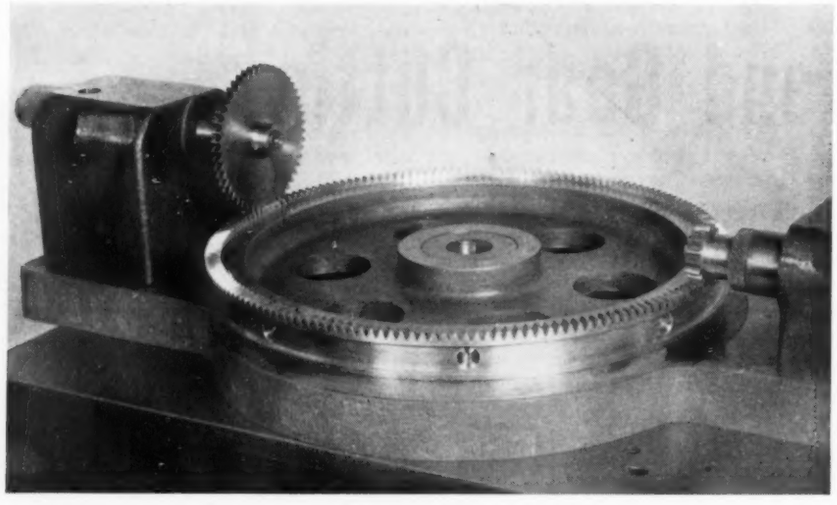


Fig. 28—Zerol pinions of two different diameters are here generated to run with the same gear

out some tolerance. With bevel gears in differential mechanisms, it is a simple matter to adjust the backlash as desired by varying pinion position. In one known instance the change to bevel gears decreased the time for assembling the gears in an instrument from eight hours to one hour, and decreased a measured error from 0.003 in. to 0.0015 in. Zerol bevel gears are being used with outstanding success in differential designs and in some cases have replaced straight bevel gears.

Fig. 26 shows a hole for a taper pin through the hub of the gears. Pins and setscrews for holding gears on shafts should be avoided because of the danger of causing runout. In small gears, however, pins may have to be used; and it is then of extreme importance to control the fit between bore and shaft by the closest practical tolerance.

For small bevel gears which may be required to operate with zero backlash a natural, common-sense procedure produces satisfactory results. In the first place the gears are manufactured with the least possible amount of eccentricity by taking special care in machining the blanks and centering them on the arbors when cutting the teeth. Next the gears are assembled and adjusted so as just not to be loose in any position. The tighter positions in the teeth are then eased down by rolling the gears together with a little mild fine-grain abrasive. With carefully made gears surprisingly little of this treatment is necessary to reach the condition where the gears rotate with no backlash and no discernible tightness in any position. Finally, the gears are disassembled, the abrasive is removed thoroughly, and the mechanism is reassembled.

Another set of bevel gears of instrument type is shown in Fig. 27. Here the teeth are Zerol, generated by a spiral cutter, although one has to look closely to see that they are not really straight. Such teeth can be generated very fast, especially when what is called the double-duplex method is used, meaning that in both gear and pinion the cutters work simultaneously on both sides of a tooth space. This kind of cutting usually requires special dimensions of the gear blanks, and the Gleason Works should be consulted. One gear and one pinion in the picture are placed so as to show the locating surfaces at their backs. The importance of adequate backing surfaces ground truly square with bores cannot be over-emphasized.

Most gears are designed and cut according to standard methods. Special cases are always occurring, however. Fig. 28 shows an unusual arrangement of right-angle bevel gears in which pinions of two different diameters are meshed with the same ring gear. The teeth are Zerol; and the narrow face width is favorable. Such jobs always require special calculations and special attention.

Fig. 29 shows a miscellaneous group of bevel gears for instrument applications. The largest diameter is about 4 in. Straight teeth, spiral teeth and Zerol teeth are all represented. The pair in the lower left center position are of bronze. All of the others are of steel. Those in the upper center and lower left have Zerol teeth, which are hardened and ground, and so will not wear under load like gears of softer material. It is naturally difficult to make fixed rules for the selection of materials, size, type of teeth and final finishing process. The manufacturer is always glad to give his advice when consulted and can usually make suggestions which result in improved results and decreased cost.

Durability Important

Gears are designed for durability and for strength. It is obvious that teeth must be big enough not to break under the required load. Old textbooks and handbooks dealt only with the strength of gear teeth; but durability is usually just as important. Except when the material is hardened steel, gears of a sufficient size to run without wearing out over a reasonable period of time at a given load and speed are almost always stronger than may be required to resist breakage. In some applications there must be no wear at all, if operation of the gears is to continue to be satisfactory.

Gear specifications include the following:

A. *General Size*
   Diameter
   Face width
   Cone distance
   Pitch angle (in bevel gears)
B. *Description of Teeth*
   Number
   Pitch
   Helix angle or spiral angle (straight teeth have 0 helix angle)
   Tooth form
   Pressure angle
   Depth
C. *Material and Treatment*
D. *Finishing process*

The whole range of tooth size may be divided into four classifications arbitrarily as follows:

Diametral Pitch	*Classification*
½ to 2	coarse pitch
2 to 8	large pitch
8 to 32	small pitch
32 and finer	fine pitch

In small gears, like those for instrument use, it is convenient to think of diametral pitch as indicating the number of teeth in a gear of 1-in. diameter.

In general pitch will vary with diameter and load.

Loads are stated in terms of torque and diameter, or in pounds tangential to the pitch circle. Often load is reduced to pounds per inch of face width. Safe values depend on material, pitch, speed, accuracy and finish. Detailed analysis usually involves estimating the load carried on one tooth and the resulting surface pressures.

Speed is given either as revolutions per minute or as feet per minute on the pitch circle. The speed at which gears are to operate must be considered in the design, and frequently determines the type of gear. General designations of speed adopted by the inspection committee of the A.G.M.A. are worth listing:

Feet per Minute	*Designation*
0 to 80	Low speed
80 to 400	Commercial medium speed
400 to 2,000	Commercial high speed
Over 2,000	Precision high speed

This list is entirely arbitrary; but it serves to indicate the range of speeds covered by gearing.

In some applications accuracy in gears and gear teeth is important even at low speed. Accuracy is always required for satisfactory operation at high speeds. Inspection of accuracy is applied to the following features:

Pitch or spacing
Profiles (pressure angle and curvature)
Lengthwise direction (lead, spiral angle) and curvature
Concentricity of teeth with bore or hub

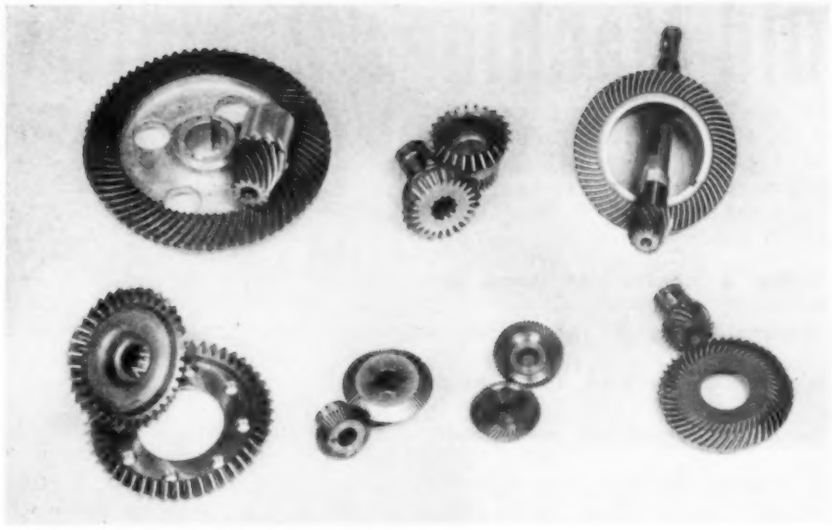


Fig. 29—Straight teeth, spiral teeth and Zerol teeth are shown in the precision bevel gears pictured here

There are various types of checking devices in which dial micrometers reading in 1/10,000 in. are employed, and some in which recording instruments are used. Accuracy of pitch and concentricity can be indicated directly and by the same general methods in all kinds of gears. In spur gears and helical gears, where the dimensions are constant from end to end of a tooth, it is possible to check profiles and leads by direct-reading instruments. In bevel gears, however, the same kind of uniformity does not exist; and inspection is done mostly by running gears together in correct position on accurately graduated testing machines.

General tolerances indicate linear errors at points on the tooth surfaces. Allowances in gears up, to say, 10-in. diameter run about as follows:

Inspection Limits—Inches	*Classification*
0.001 to 0.002	Ordinary commercial
0.0005 to 0.001	Good commercial
0.0002 to 0.0003	Precision

Limits of 0.0001 to 0.0002 in. are sometimes obtainable, but not under usual manufacturing conditions. Naturally, the closer the limits the higher the cost. It is a mistake to demand higher accuracy than is required for a given application. On the other hand, precision results can be obtained only by the necessary degree of accuracy.

Diameter, number of teeth and pitch in gears are interrelated. In general, for given diameters, fewer teeth are stronger and cost less to cut. More teeth, however, may result in smoother motion and perhaps slightly greater durability. In straight-tooth bevel gears, for instance, 15/15 teeth are entirely satisfactory for many purposes; but if precision of motion is especially desired, 30/30 teeth would be preferred. Note that in spur gears having approximately equivalent cross-sections the numbers of teeth would be 20/20 and 40/40, respectively.

When the number of teeth is decreased, the length of the tooth profile becomes greater in proportion to the diameter, and this makes smooth motion more difficult to obtain. Going in the other direction, after the number of teeth becomes sufficient to insure satisfactory precision, further increase in number does not bring further improvement, but makes cutting tools weaker and increases cost. The decrease in tooth size may also lead to danger of breakage.

Design must always be based on knowledge and experience. General formulas and tables must be used with judgment. One designer may naturally take more interest in gears than another. It is suggested, therefore, that such an individual in an engineering office be encouraged to give special attention to gear design and become familiar with the best methods and practices.

This concludes a series of three articles by Mr. Candee.

Old Machines Rebuilt for War Work

BY HERBERT E. FLEMING

Using a centralized shop for dismantling and rehabilitating discarded machine tools helps to equip expanding war plants

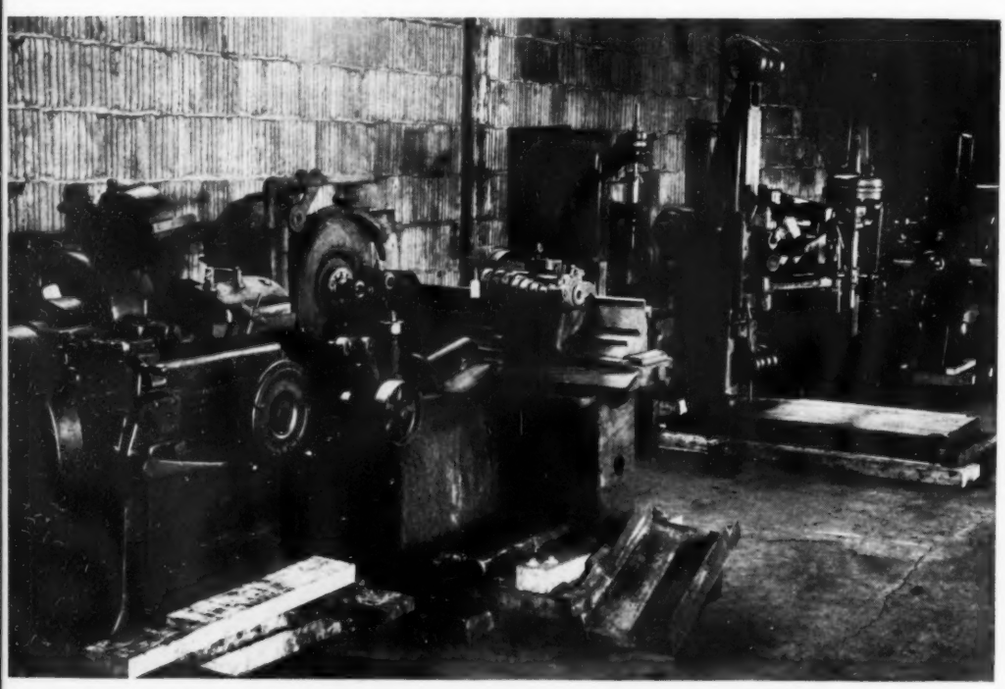
REHABILITATION of a great variety of discarded machine tools—lathes, grinders, drills, milling machines, hobbers and others—is done in a special central machine tool shop conducted by the International Harvester Company. It is a modern shop acquired by the Army and leased to the company for that particular purpose. This shop, managed by the company's machine tool specialist, has a force of 60 machinists, half of them skilled veterans in precision work, the other half trained mechanics.

Many of the old machines come in as rusty wrecks. Ways and slides of lathes are rough. Often handwheels are missing. In one case a braized handwheel was held in place with a nail. And when the old machines are opened up, in many cases gear boxes are found to be full of chips, dirt, and rust. Shafts and spindles are found to be in need of metallizing; gears and racks to be in need of teeth; bushings and clutches in need of reconditioning or replacement.

After rehabilitation at this shop the machines ordinarily, although not always, go back to the respective plants from which they came, for use in war production. They go back, not only with columns and frames painted in battleship gray, but with their exterior and interior working parts reconditioned and adjusted, and lubricated, in good running order. C. D. Bending, supervisor of machine tools for the International Harvester Company, rates the rehabilitated machines differently according to their degrees of perfection. Some he rates merely as "usable," either for their original work or, by adaptation, for some special war work; some are rated as "good as new"; and some, such as lathes where the castings of long ways have had the benefit of outdoor seasoning, he rates as "better than new."

The methods followed at this shop in achieving these results are more elaborate than ordinary repair work in a plant to keep a machine running. They are truly those of rehabilitation.

Each machine is dismantled. It is thoroughly examined to discover the missing parts and to appraise the condition of worn parts. An early decision made is whether a worn part can be reconditioned by welding. For missing parts such as handwheels on lathes, milling machines, and grinders, if they cannot be secured promptly from the machine tool manufacturers, the pattern section of the Harvester machine shop makes wood patterns, sends the patterns out, and has castings made from them. New gears are cut on the milling machines in the shops. Shafts and spindles when worn below size are metallized, in some cases in this shop, in others by outside jobbing shops. Bearings are carefully adjusted. Tables of milling machines are remachined for truing up. Turrets of turret lathes are refaced. Ways and slides of lathes are planed on a planer and handscraped. The ways are coated with red lead to bring out the high spots, and veteran bench mechanics, using scrapers, make them perfectly smooth and true. The final step in the methods followed is a use test in actual operation of each rehabilitated machine.

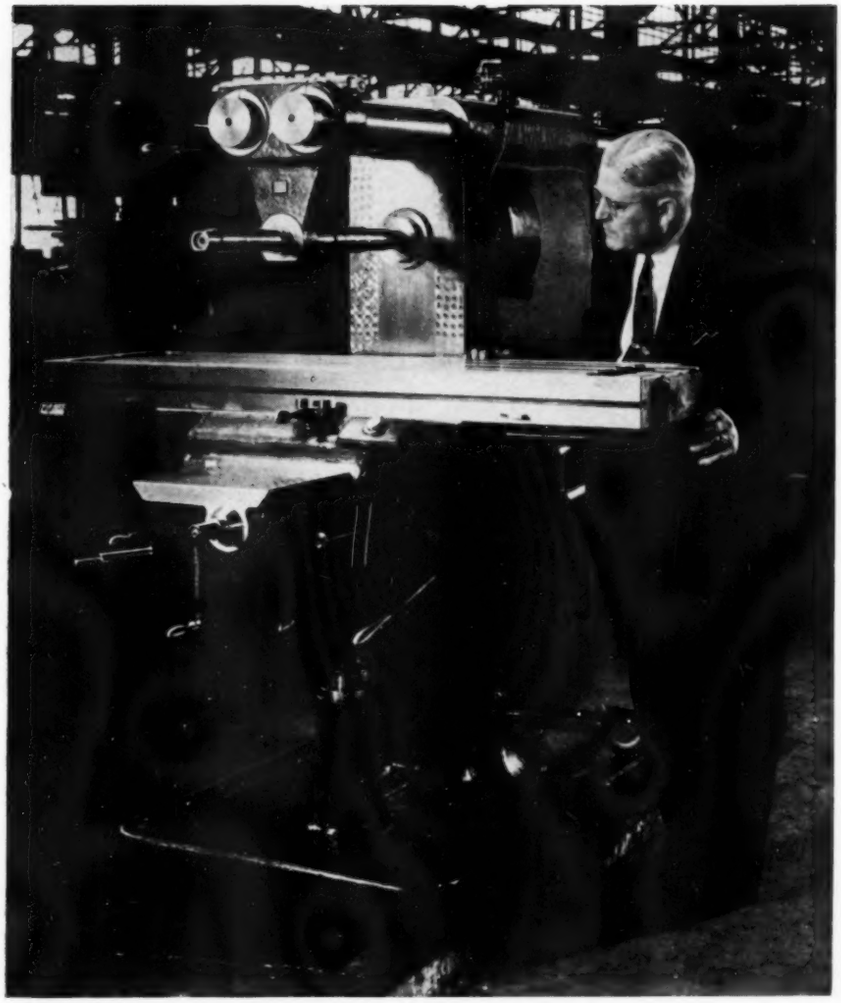


These old machines, in the receiving department, indicate the condition in which machines are received for rehabilitation

Overhaul Must Be Thorough

A Milwaukee milling machine had been operated continuously for 16 years, much of the time on three shifts, making farm tractors. It had been set aside among idle machines, no longer useful. On arrival at the rehabilitation shop it was in condition described as horrible. Inside, the gear boxes were full of turnings. Parts such as knee- and slide-bevel, worm and spur gears were worn or missing. The surfaces of the table and the column had to be remachined and scraped. To renew the table new castings had to be put in place at its ends. The whole job was not regarded as difficult, but the overhauling and renewing had to be thorough. This machine has gone back to the plant from which it came, one of a group of plants engaged in the manufacture of tank parts, and is now in operation.

Another star case of rehabilitation is



C. D. Binding, who heads the rehabilitation work, fingers the table of a rebuilt Milwaukee milling machine

that of a 10×36-in. Norton internal grinding machine, which was built in 1918 and had been in use for the 24 years since then. This machine, except for the frame, was completely rebuilt. The ways, the table, the wheel-head and the wheel-head slide were re-machined and hand scraped; the spindle bearings were renewed; and by means of new gearing, bushing, shafts and clutches the machine had its "intestinal fortitude" restored. For replacement of some of the parts, such as pulleys and pump, patterns were made and sent out for the securing of castings.

When a double-end Sunstrand centering machine, built in 1929, was received it was completely worn out. In reconditioning it, all the finished surfaces were machined, new spindles and spindle bearings were put in place, the turret was rebored, rebushed, and refaced, and trued up in line with the spindle. As a result, this machine was in the line of those ready for shipment to one of the plants having an urgent need for it.

An American Tool engine lathe, purchased in 1905, came to the shop out of the scrap yard at one of the plants. This 37-year old machine is now back in war production. To bring that about called for various lines of reconditioning. One was supplying it with a new headstock. Another was metallizing the spindle bearings. Another was cutting teeth in gears, by means of the shop milling machines.

Cooperation from Builders

In the rehabilitation work at the Harvester machine shop the management of the shop is getting liberal cooperation from the machine tool manufactures, with their catalogs, advice from their sales engineers, and sometimes with replacement parts. But as is well known in the industry, the machine tool manufacturers often cannot stop to ship out parts for old machines. Notwithstanding their remarkable increases in production, they are pushed to the limit on rush orders for complete new machine tools for war industries.

Like other manufacturers converting largely to war production, Harvester often found that either it could not obtain needed new machine tools at all or else would have well-nigh hopeless delays in obtaining them. From the outset of the defense production period the company had followed the policy of not selling obsolete or worn-out or adaptable machines except for war production. Moreover, this company had succeeded in offsetting delays about getting small cutting tools by setting up a centralized tool salvage department at its Milwaukee Works and gathering

The 16-year old, rusty run-down Norton grinder at the left is ready for a reconditioning such as the 24-year old grinder at the right has just received

into that department worn cutting tools from all its plants and providing for their rehabilitation. Furthermore, in getting started on the manufacture of 75-mm. shells at one of its plants, J. E. Harris, now superintendent of another Harvester plant making 20-mm. automatic airplane cannon, had found that by adding skilled machinists to the toolmakers in the plant's machine shop old abandoned machines would be rehabilitated with such success as to advance production advantageously.

So when the company took on the manufacture of the T-7 light tank for the Ordnance Department, it pointed out that production could be pushed to advantage, with savings of thousands of hours at the plants and thousands of dollars for the taxpayers, if it set up a centralized machine shop primarily for rehabilitating and adapting old machine tools of most of the kinds required.

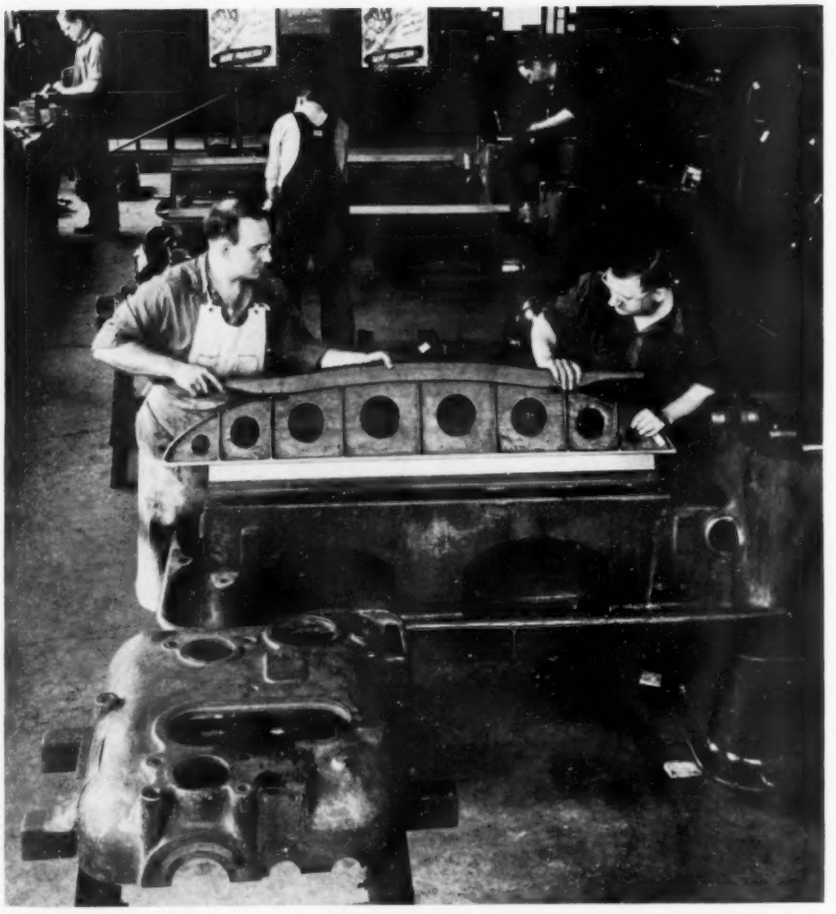
Selecting the Plant

Told to go ahead, the company found a plant where the equipment included fifteen engine lathes, seven planers, two vertical boring mills, two shapers, two radial drills, three milling machines, one internal grinding machine, one external grinding machine, facilities for arc welding and acetylene welding, wood pattern making equipment, and 30 bench vises.

Another feature of the plant was that the Ostrander-Seymour Company, which had operated it, had a force of 35 skilled bench mechanics, who had been in that company's work on the average for fifteen years and who were available to carry on as a Harvester shop force, or at least as the foundation of such a force. So were their machine foreman and their bench foreman, the latter having been on the job since 1902.

At first only four of these machinists were put on harvester work. Then each week more were transferred to it. By March 15 the Ostrander-Seymour work had been cleaned up, and all were engaged on Harvester rehabilitation of machines for war production.

Since then the force has been built up to 60, and it is planned to increase it to 150. In the recruiting, one of the seasoned machinists added to the force is a former gunsmith, aged 64, who had retired, but, being in good health, was desirous of doing his bit in war work at his trade, and so applied for a job at this shop. Several others had been in automobile repair shops. Two such had owned their own businesses, but had been closed out by the war limitations. They have advanced rapidly toward the status of mechanics. Each veteran machinist is given one or more inexperienced men to help him and be trained by him. Among the latter are white collar men who never before had been in a machine shop. One of these, for example, was formerly a salesman, not of industrial equipment, but of insurance. He had been attending a machine-shop practice school for a week when he was taken on. His case is cited as an example of how an alert man with no previous mechanical experience can advance in promising fashion in these days when it is necessary to produce quickly not only machine-tools but also machinists and machinists' helpers. No formal classes are held, and of course it is found that some of the veteran machinists are more skillful than others in teaching their helpers.



A group of machinists are rebuilding several 4-in. Lo-swing lathes. The men in the foreground are using a large straight edge for marking the ways

Industrial Truck Care Pays Dividends

Because of the ruggedness of industrial trucks, maintenance is neglected in many plants according to A. E. Dorod, assistant chief engineer, Baker Industrial Truck Division of The Baker-Raulang Company. Trucks are forced, by going from low to high speed with heavy loads; they are plugged in reverse to stop; they are rammed and skidded around corners.

To care properly for industrial trucks, good floor conditions should be provided and the trucks should not be overloaded. The truck should be inspected weekly by a competent mechanic, and lubricated regularly according to the manufacturer's recommendations. A log should be kept covering the inspection findings, lubrications, adjustments, and repairs. In this way any part calling for excessive care can be spotted and the cause corrected before serious damage occurs. It is well to blow the dust off the truck daily before oiling. The battery should be checked at the same time. It is advisable to make a complete overhaul every six months.

Proper Care of V-Belts

BY L. L. SMITH, MECHANICAL ENGINEER, TEXROPE DIVISION, ALLIS-CHALMERS MANUFACTURING COMPANY

Here are nine simple rules for installation and maintenance of V-belts. Adherence to them will result in long and trouble-free service from the drives

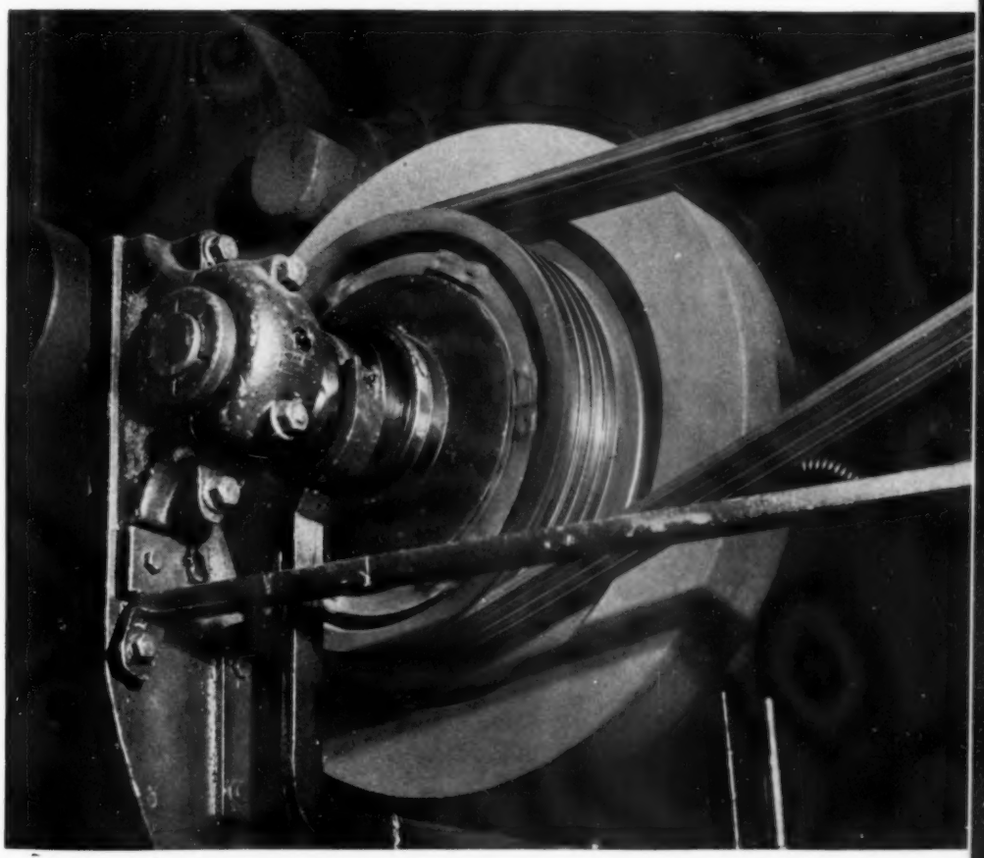
A REVIEW of complaints on V-belt installation troubles indicates that certain simple rules are being neglected to the detriment of efficient use of production power. To avoid this, attention should be given to the following items:

1. Buy the V-belt for the job. There are available general-purpose belts which generally should not be used at temperatures exceeding 120 to 130 F. Special heat-resisting belts are available for higher temperatures and are satisfactory up to 180 to 200 F. Standard belts possess some resistance to oil, dilute acids and unusual types of atmosphere; however, longer life can be obtained by purchasing special oil-resisting belts.

2. A straight edge should be used to obtain the proper alignment of driver and driven shaft, which should be parallel with the V-belts running at right angles to the shafts. This will avoid undue wear which any appreciable misalignment always causes.

3. Every V-belt drive installation should include some form of movement for maintaining the proper tension on the V-belts. This can be accomplished by slide rails on the motor, an adjustable motor base, or an idler arrangement which may be employed when no other arrangement is available. After the drive is properly lined up and installed, enough tension should be placed on it to make the V-belts tight. The tight side of the drive should preferably be on the top, although it is not absolutely necessary. V-belts stretch approximately 10 percent of their original pitch length during their operating life. Enough movement should be allowed to permit this amount of take-up so that the proper tension can be maintained at all times.

4. All V-belt drives should be inspected periodically to be sure the proper tension is being maintained.



5. Matched sets of V-belts are desirable for every installation. This permits each respective belt to carry its proportionate share of the load. This matching should be in accordance with the allowable tolerances for the various size belts. For Texrope belts this varies from a no tolerance on the 55-in. pitch length belt to a 0.6-in. tolerance on a 660-in. pitch length belt.

6. V-belts should be replaced in the following manner: All tension should be removed from the drive and as much slack as possible obtained on the V-belt; a complete set of new belts should be placed on the drives; the alignment of the drive should again be checked and the proper tension applied. Replacement should be made with a complete new set of V-belts because it is difficult to match two or three new belts with several old belts that have stretched an unknown amount. The old belts which are still good may be used for replacement purposes in case of accidents or breakage. The belts from the new set will have stretched sufficiently by this time to permit using the old belts for replacement and provide a fairly well matched drive.

7. V-belts should never be pried on to the sheave. A bar, piece of pipe, or any other object that might be used for this purpose may rupture the cord construction of the belt, and cause early failure.

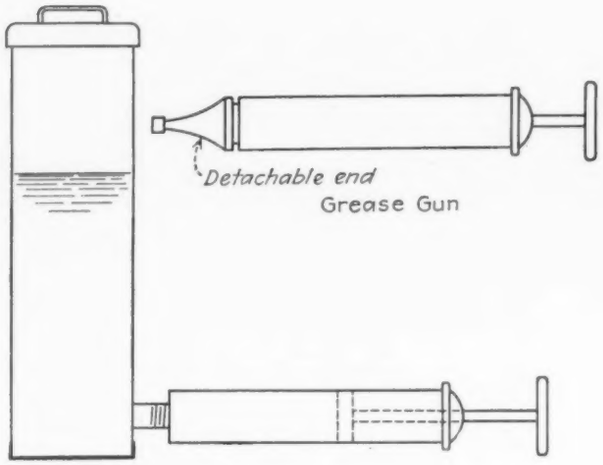
8. When spare sets of V-belts are carried they should be stored in a cool, dry place, protected from light. Heat and light will cause the rubber to deteriorate and shorten its life.

9. Belt dressing should never be used on V-belt drives. The principle of the V-belt drive is the frictional contact. Belt dressing may cause the surfaces to become slippery, allowing the drive to slip with a resultant loss of power. Belt dressing may also cause deterioration and shorten the belt life.

WAR-S

Quick Way to Load Grease Gun

A special fitting for loading a grease gun from a grease barrel will eliminate the waste of grease, time and cleaning required normally. The fitting is threaded to fit the end of the grease gun and then attached to the bottom of a discarded grease container. A cap is made to cover the outlet when not in use.



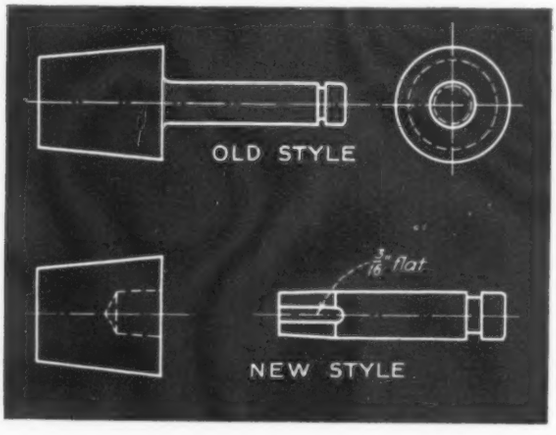
In operation, the detachable end is removed from the grease gun. With the gun handle pushed in, the gun is screwed to the fitting. The handle is withdrawn, filling the gun. The gun is removed from the tank and the detachable end is replaced. *Suggested by S. Schonfeld, floor covering department, Paraffine Industries.*

Two-Piece Rivet Sets

Flat head rivet sets used at the White Motor Company frequently broke off where the shank met the head. These rivet sets were made from one piece and stresses at this point made it weaker.

When breakage occurred the heads were salvaged by drilling a hole in them and fitting a new shank into the hole. Since there were no stresses in these shanks there was little difficulty from breakage of salvage rivet sets.

It was suggested that if all of the rivet sets were made in two pieces to start with there would be less lost time through breakage and the expense of salvage would be eliminated. The head is now made from tool steel with a hole $\frac{1}{2}$ in. deep which has a taper of $\frac{1}{4}$ in. per foot. The shank is made from cold rolled steel with a similar taper $\frac{5}{8}$ in. long. A flat on this taper serves as a vent when the two pieces are assembled. The shank is press fitted into the head. *Suggested by John Glowe, White Motor Company.*



Puller for Cotter Keys

As a regular part of aircraft engine construction, each engine is tested on the dynamometer after completion and then completely torn down, checked over, reassembled and tested again. In the tear-down, scores of cotter pins must be removed. Usual practice has been to unbend the cotter key by pliers, screw driver or a marketed puller. All of these methods had certain drawbacks.

It was suggested that a pulling device like that shown in the drawing be built, consisting of a rod with hook at one end and a handle at the other. A heavy sliding block on the shaft can be butted against a leather washer where the handle begins. The procedure is to hook the cotter pin, grasp the handle firmly and with the other hand, sharply drive the weighted block against the leather washer. The effect is to quickly straighten and remove the bent cotter key.

A multiple operation is thus simplified and speeded up. The use of this puller also removes the danger of damaging threaded bolt or nut. *Suggested by Peter Horbe, gage and tool maker, Aircraft Engine Division, Packard Motor Car Company.*

WINNING SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

Three-Shift Schedule of Operation

When an increase in production was necessary at the Cleveland Automatic Machine Company, two men who were not employed in the planning department worked out a schedule providing for 24-hour, seven-day operation which was submitted to the production drive committee.

The plan provided a solution to the problems involved and was adopted by the company. Under the schedule, which is shown in the table, every employee has one day off per week. When a man has a "day off" it gives him a full 40 hours—that is, the 16 hours normally elapsing between the finish of one day's work and the start of the next, plus a 24-hour holiday.

SCHEDULE FOR 7 DAY OPERATION

	First Shift		Second Shift		Third Shift	
	P.M. 6 to A.M. 8		A.M. 6 to P.M. 4		P.M. 4 to A.M. 6	
Sat.		8		10		12
Sun.	Day off	0		10		8
Mon.		12	Day off	0		12
Tues.		8		12	Day off	0
Wed.		12		8		8
Thurs.		8		8		8
Fri.		8		10		12
Sat.	Day off	0		10		8
Sun.		12	Day off	0		12
Mon.		8		12	Day off	0
Tues.		12		8		8
Wed.		8		8		8
Thurs.		8		8		8
Fri.		8		8		8
Sat.		12	Day off	0		12
Sun.		8		12	Day off	0
Mon.		12		10		12
Tues.	Day off	0		10		8
Wed.		8		8		8
Thurs.		8		8		8
Fri.		8		8		8
Sat.		8		12	Day off	0
Sun.		12		10		12
Mon.	Day off	0		10		8
Tues.		12	Day off	0		12
Wed.		8		8		8
Thurs.		8		8		8
Fri.		8		8		8

The off days are arranged in a four-week cycle which provides for a Saturday, Sunday, Monday or Tuesday off. The scheduled hours for each shift are so arranged that an employee's relaxation habits are consistent. The starting and stopping times have been arranged to suit the times when transportation is normally available.

As can be seen from the table, when one shift is taking the day off the other two shifts divide the time between them. This provides an average work week of 56 hours with 70-pay hours for each employee. This meant no change in the earnings previously received. The plan has been enthusiastically accepted by the employees. *Suggested by George Timms, assembly department, and Raymond Shrider, inspection, Cleveland Automatic Machine Company.*

Fixture for Detecting Concentricity

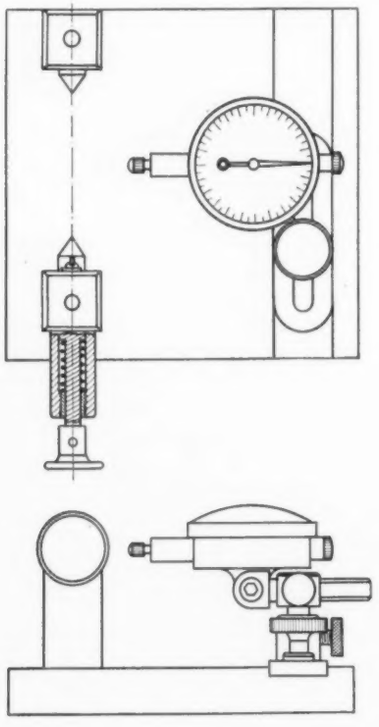
No accurate method of assuring the operator that he was grinding the outside diameter of cones concentric with the bore was available at the Link Belt Company. The cones were fastened on the grinder with expansion mandrels which were of delicate construction so that a little dirt or too much tightening might spring them out of true without the operator's knowledge.

The method of checking this was to use a taper lock plug end. This plug gage was generally in use in another department so that he would have to leave his machine to hunt it up. He would then have to take work and gage to another point where centers were kept for general use. There would often be delay both in getting the gage and access to the centers. If the test indicated that the grind was not concentric, the operator would have to return to the machine,

make adjustments, turn out another cone, and test this. This would have to be repeated until the machine was properly adjusted. During this time he would be holding up the workman from whom the plug gage was borrowed, or if he returned it he would have to go back and borrow it each time he completed a part.

A fixture was designed by a workman for testing cones at the machine. In this way the work can be checked more often and more accurately. A series of tapered arbors were made to fit the various sizes of cones produced. These arbors are all 2¾ in. long. On a fixture base centers were mounted to fit these arbors. One center was spring-operated to permit easy placement of the work to be tested.

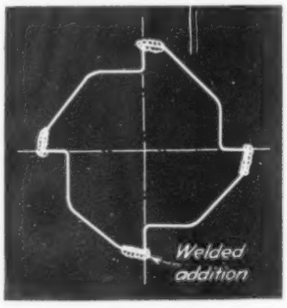
Also mounted on the fixture base was a dial indicator, as shown in the drawing. In operation the cone to be tested is slipped over a taper arbor and mounted between the centers. With the point of the dial indicator resting against the outside diameter the cone is revolved and any variation in concentricity will be indicated by the dial. *Suggested by Joseph Kautsky, Link Belt Company.*



Welding Rod Rebuilds Reamers

The maximum allowable wear in reamers used in the production of 37-mm. shell at the Newark Stove Company was 0.0027 in. from the original dimension on the finished reamer. The production of reamers required approximately 2,000 man-hours per month, plus the use of about 1,000 lb. of tungsten high speed steel bar stock 1⅛ in. in diameter each month.

Inability to procure the proper materials would have resulted in a temporary shutdown had it not been suggested that the worn reamers be reclaimed by refacing the cutting edge. This was done by applying Stellite welding rod using an acetylene torch. The reamers were built up large enough to permit regrinding and backing off, making the tool identical in dimension with the original tool made from high speed bar stock.



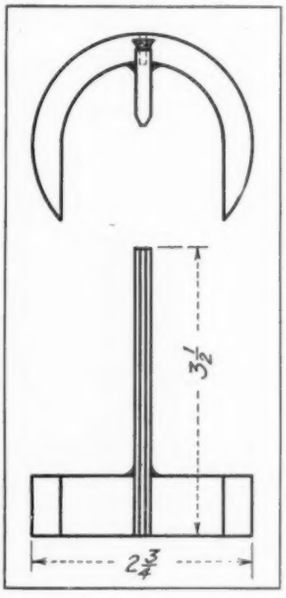
Performance of the built-up reamers has indicated that they are equal to the original reamers. Tests show that the reclaimed reamers have produced upwards of 3,000 shell with only two grinds. *Suggested by G. W. Lewis, tool department, Newark Stove Company.*

Convenient Drill Square

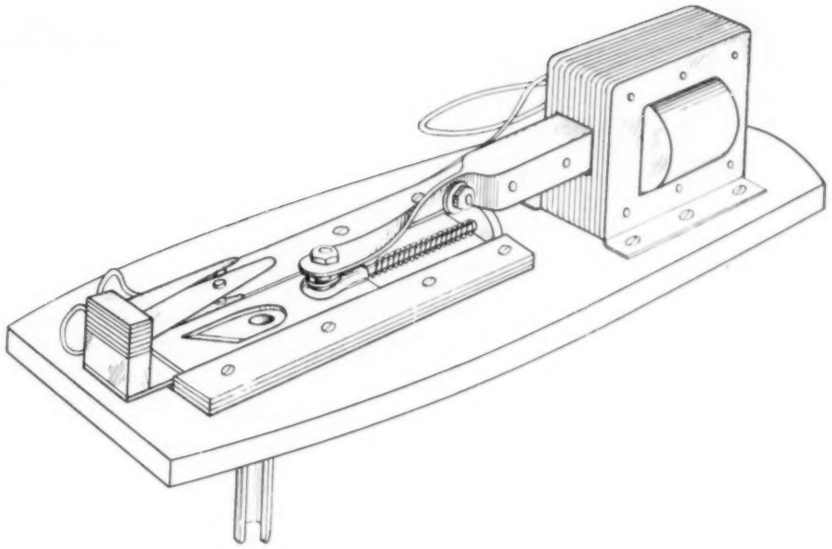
The drill square shown in the drawing was suggested for use in squaring a reamer in spot-face surfaces. It has proven especially useful in inaccessible places where a regular square cannot be applied.

The square is made with a machine steel base and a tool steel blade. The two parts are brazed together to form the square. To further increase the rigidity, two small pins are mounted between the base and the blade. Holes are drilled in each piece and the pins fitted in accurately, after which the brazing operation is performed.

This square can be used in any type of drilling and reaming of various sizes, for drilling holes and for squaring a drill. *Suggested by H. M. Lowry, Bethlehem Steel Company.*



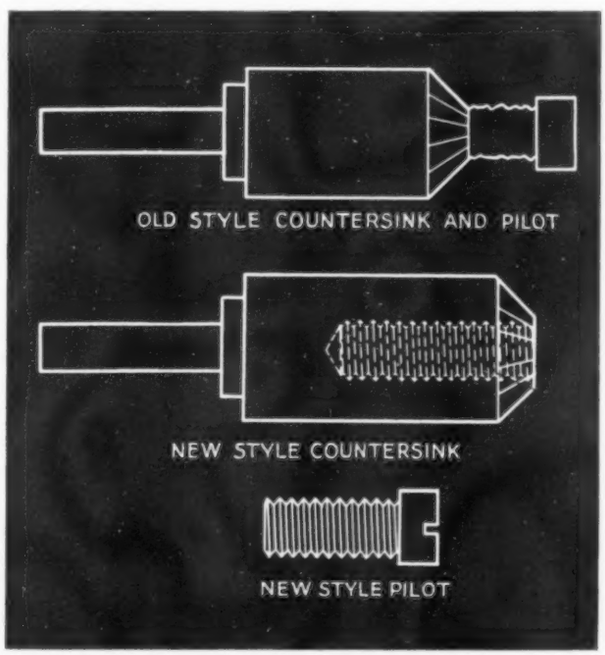
Rubber Tubing Cutter



It was the practice to cut rubber tubing into short sections by hand at Northrop Aircraft, Inc., until a workman designed and built a device for automatically cutting the tubing into equal lengths. The cutter is made in the form of a small box into which the tubing is fed by hand. The mechanism is attached to the lid of the box and, in the drawing at the right, is illustrated in an inverted position.

A hole is drilled in the box lid and a short piece of metal pipe is fitted into this so that it is flush with the inside of the box lid. The inside diameter of the tube is such that the rubber tubing to be cut will slip through it. The blade that does the cutting has a hole in it which is normally beneath this opening in the lid. The tubing to be cut is slipped into the metal tube and down into the box, passing through the blade, until it strikes a stop. This stop is a short section of leaf spring which is depressed by the pressure of the tubing until it hits an electric contact just beneath it. This action closes the circuit and actuates the solenoid at the other end of the mechanism. A plunger is fitted into the solenoid and to the end of this the knife blade is attached. When the circuit is closed the plunger is drawn into the solenoid and the knife blade is pulled in that direction along the under side of the box lid. The knife edge along one side of the hole in the blade shears off the tubing.

The cut tubing falls into the box, releasing the pressure on the leaf spring. When this happens, the circuit is broken and a spring returns the blade to its normal position ready for the tubing to be pushed down again. Tubing can be cut just as rapidly as the solenoid can be actuated. *Suggested by Sam D. Carter, Northrop Aircraft, Inc.*



Adjustable Pilot for Countersink

Countersinks which had a solid pilot were used for countersinking in sheet metal by the Nordberg Manufacturing Company. When the countersink was sharpened the pilot was naturally farther out in front of the cutting edges. Repeated sharpenings ground the tool back so far that the pilot would pass through the sheet metal which was being countersunk and protrude on the other side. The shank between the pilot and the cutting edges was irregular because the edge of the grinding wheel would cut into it on each sharpening. Consequently when the complete pilot passed through the sheet metal, there was no longer any piloting action provided, and the countersink had to be discarded.

A countersink which has an adjustable pilot was suggested by a workman and has been adopted. In this the pilot is made as a separate piece which is threaded to fit into the end of the countersink. When the tool is worn, the end can be ground off and the pilot screwed farther into the tool shank to return it to its normal position relative to the cutting edges. *Suggested by John Bacher, Nordberg Manufacturing Company.*

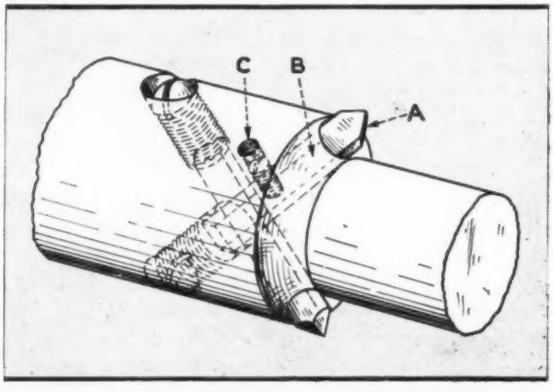
IDEAS FROM PRACTICAL MEN

Two-Tool Boring Bar

BY R. H. WELLER

Two toolbits can be arranged in a boring bar so that they are independently adjustable and with both tools cutting on the same diameter. A marked economy in the amount of tool steel used results, as well as a saving in time in the toolroom.

Toolbits *A* are short lengths of round stock with a sizable flat on the leading face. Holes *B* in the bar are offset from the center line half the diameter of the tool stock plus about 0.004 in. for clearance.



A boring bar made with two toolbits which are independently adjustable divides the cutting force

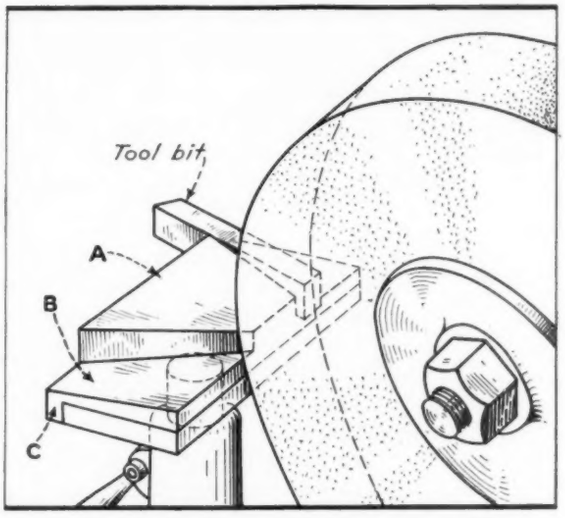
The soft toolbits are assembled in the bar and clamped with setscrews *C*. Then the whole bar is mounted on centers in a lathe and the bits turned and faced to size. The relief is filed on the bits and the holes and bits numbered before removal for hardening. After hardening the bits are replaced and clamped in their corresponding hole and may be ground on centers to a definite diameter using the backing screws for adjustment.

The smallest bar so far made by this method was for boring a hole $\frac{3}{4}$ in. in diameter, using $\frac{3}{16}$ in. diameter bits. Larger holes will use proportionately larger bits. The advantages of this type of bar include the fact that the brunt of cutting is divided between two tools, but it does away with hand filing necessary to make a rectangular hole for the regular type of square tool bit.

Blocks for Grinding Threading Tools

BY D. E. McDONALD

When machinists are responsible for grinding and forming their own threading tools, the block shown in the drawing will be useful. The block is shaped



A block cut to fit on the grinding wheel table makes it easy to grind toolbits for threading

from tool steel with center column *A* machined to an angle of 30 deg. on each side, forming an included angle of 60 deg. Top face *B* on each side of the center column slopes back at an angle of 5 deg. Projection *C* on the block is made to fit against the edge of the grinding wheel table.

When it becomes necessary to grind or touch up the threading tool, it is only necessary to place the toolbit alongside either the right- or left-column face and hold it in place while sliding the block back and forth across the wheel face. When one side of the tool has been ground, it is placed on the other side of the column face, and the other half is ground. The tool is held against the column face by the index and middle finger while the thumb rests against the other side of the column face.

Blocks of this kind can be made to grind the Acme threading tools as well, in which case the angle of a column face each side of the center would be $14\frac{1}{2}$ deg.

Buttress Threads Checked By Three-Wire Method

BY B. SPECTOR

In the manufacture of buttress threads as per Fig. 1, the pitch diameter was to be measured accurately so it would pass inspection by the Army. Formulas for *y* and *MW* are not available for "bastard" threads, but the three-wire method of measurement was applied as follows. To get true size of wires *W*, a large sketch of the thread is drawn to scale as in Fig. 2 and a standard size of wires is

selected. The wires must touch the straight lines CG and CH and the top of the wires must be above the top of the threads. It is now necessary to obtain a value of y in terms of R and P (P = pitch).

Referring to Fig. 2, PL is the pitch line parallel to the axis of the thread. It is evident that the solution to the problem consists in finding the vertical distance DE. It is found by first finding CE from the triangle OEC and then finding CD from the triangle CDJ, as follows (all triangles are right angle triangles):

$$\text{In } \Delta\ OCL,\ OC = R \operatorname{cosec} \frac{A+B}{2}$$

$$\text{In } \Delta\ OCE,\ CE = OC \cos \frac{A-B}{2}$$

$$\text{or,} \qquad CE = R \operatorname{cosec} \frac{A+B}{2} \cos \frac{A-B}{2} \quad \ldots\ldots\ 1$$

We thus have CE in terms of known quantities. We now have to find CD in terms of known quantities, for we seek $DE = CE - CD$.

In the triangle CDJ we have angle B. It is now necessary to find x in terms of known quantities (the known pitch P of the thread). Eliminate x from the two triangles CDJ and CDK by equating the value CD thus:

$$CD = x \cot B = \frac{P - 2x}{2} \cot A \quad \ldots\ldots\ 2$$

$$2x \cot B = P \cot A - 2x \cot A$$

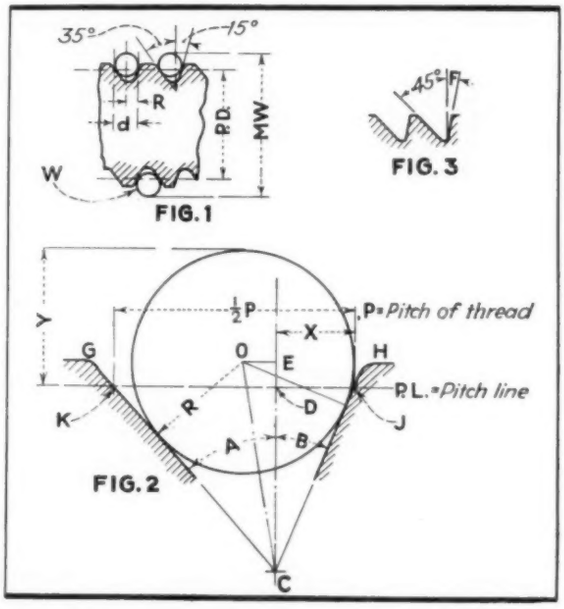
$$2 (\cot A + \cot B)\, x = P \cot A$$

$$x = \frac{P \cot A}{2 (\cot A + \cot B)} \quad \ldots\ldots\ 3$$

Substitute the value of x from (3) in (2),

$$CD = \frac{P \cot A \cot B}{2 (\cot A + \cot B)} \quad \ldots\ldots\ 4$$

Since $DE = CE - CD$, we have from (2) and (4),



The pitch diameter of buttress threads can be checked by the three-wire method. These drawings show the dimensions and letters used in the equations

$$DE = R \operatorname{cosec} \frac{A+B}{2} \cos \frac{A-B}{2} - \frac{P \cot A + \cot B}{2 (\cot A + \cot B} \quad \ldots\ 5$$

DE is the value sought. (5) is a general formula applying to any angles A and B.

Substituting the given values in the case in question, Fig. 1,

$$DE = R \operatorname{cosec} 25° \times \cos 10° - \tfrac{1}{2} P \frac{\cot 35° \times \cot 15°}{\cot 35° + \cot 15°}$$

$$= R2.3662 \times 0.9848 - \tfrac{1}{2} P \frac{1.428 \times 3.732}{1.428 + 3.732}$$

$$= 2.3302 R - \tfrac{1}{2} P \frac{5.304}{5.16}$$

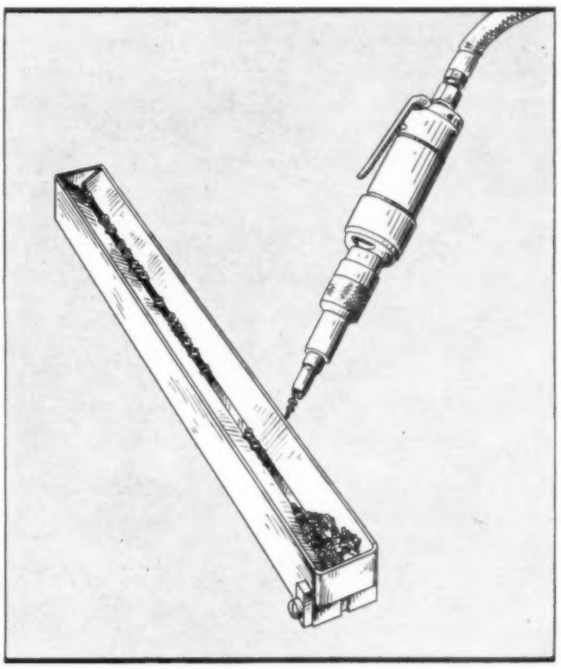
$$= 2.3302 \text{ R} - \tfrac{1}{2} \text{ P } 1.0325$$

$$y = DE + R$$

$$= 3.3302 R - 0.51625 P \text{ and}$$

$$MW = PD + 2y = PD + 6.6604 R - 1.0325 P \quad \ldots\ldots\ 6$$

The ideal buttress thread is the one in which $F = O$ in Fig. 3. Owing to the difficulty in cutting, F is from 1 deg. to 5 deg. In the German "saw tooth" thread F is 3 deg.



This arrangement for picking up and starting small screws saves about half of the time required with the hand-start methods

Screw Pick-up for Assembly Operations

BY C. T. PACKER

Westinghouse Electric & Mfg. Company

Screws of assorted sizes are used for assembling many types of mechanical apparatus. The method of assembly generally is to pick up the screws and start them by hand, completing the operation with a hand or power driver.

The time lost in this hand operation prompted the writer to develop the screw pick-up shown in the drawing. Since a large percentage of all screws are

of the fillister-type head, the method described is for picking up and driving that type of screw.

The first step necessary was to develop a fixture which will position the screws ready to be picked up. This was done by making a metal trough with slot of sufficient width to permit the body of the screw to enter but not the head. This fixture can be of any suitable length. Of a handful of screws strewn along the length of this trough, many will automatically settle with head in position to be picked up.

A three-split sleeve mounted around a screw-driver bit can be used for machine screws in sizes from No. 4 to No. 12. This sleeve should have sufficient tension to pick up and to hold the screw firmly and should extend beyond the bit for a distance slightly less than the distance from the bottom of the screw slot to the bottom of the head. A thin sleeve of suitable length, and slightly larger, protects the sleeve spring and extends to about $\frac{1}{16}$ in. above the end of the spring sleeve. This protecting sleeve is sweated onto the spring sleeve at the top.

This pick-up may be used in an air or electric driver. Picking up is accomplished by placing the tool over the screw head in the selector trough and applying sufficient pressure to expand the sleeve over the head. To make a pick-up, the entire assembly should be turning so that the screw driver bit will be sure to engage in the screw slot.

Reaming on a Drill Press

BY H. W. STOWELL

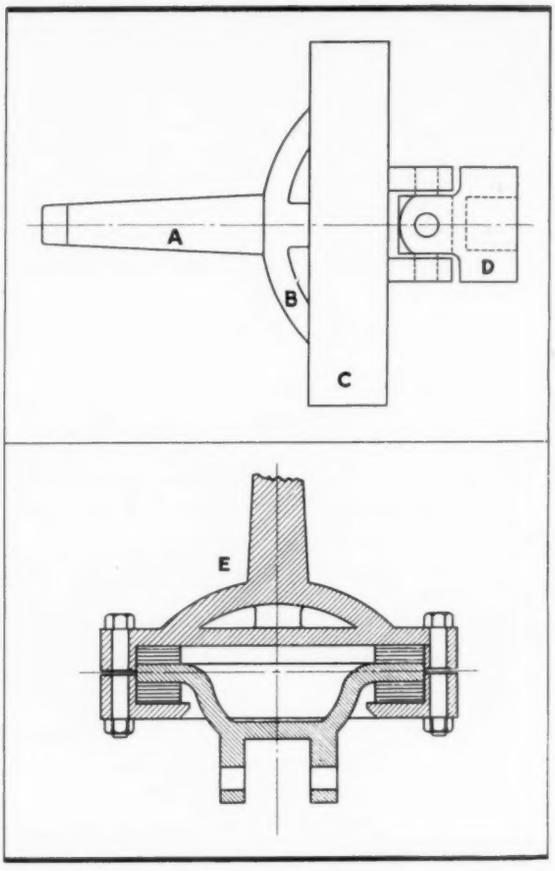
It is often desirable to ream holes on the drill press immediately after they are drilled and unless the proper attachments are available trouble begins. Efforts to ream with an ordinary socket in the drill press spindle result in holes out of round. Reamers sometimes "hog in", gouging the hole, breaking sockets, damaging the tools and machinery.

In connection with the heavy reaming done in locomotive shops and shipyards the familiar flat type of air motor can be used to advantage. The flexibility of air power and the fact that the motor will stall if the reamer sticks makes it an excellent tool for this purpose. Experience also shows that a reamer will not cut true unless it floats and is thus free to align itself with the hole as it is being reamed.

The floating reamer socket and clutch combined which is shown in the drawing will give these advantages to reaming on a drill press. Shank *A* is made to fit the drill press spindle and is attached by spider *B* to clutch *C*. This is attached to the reamer by knuckle socket *D*.

A motorcycle clutch is excellent for this purpose and may be adjusted to slip at definite torque. Often such a clutch may be obtained from an old machine and the reaming attachment can be made. These clutches are well made and will stand a great deal of slipping and abuse.

If it is necessary to make a clutch it can be made as shown at *E* in the drawing. The friction element is made from wood.



A floating reamer socket and clutch combined make it possible to perform heavy reaming operations on a drill press

To ream a long hole with a drill press the lower end of the reamer is supported with a board or jack, and this is lowered slowly as the reamer feeds down. If the reamer catches the clutch will slip, giving the operator a chance to stop the machine. It is then necessary to back out the reamer with a soft hammer and try again.

A temporary edge may be restored to a dull reamer by scraping the cutting edge with a chisel or file in such a manner as to turn up a cutting edge and increase the clearance. The edge will then last long enough to ream several holes.

Cotton Stops Chattering Countersink

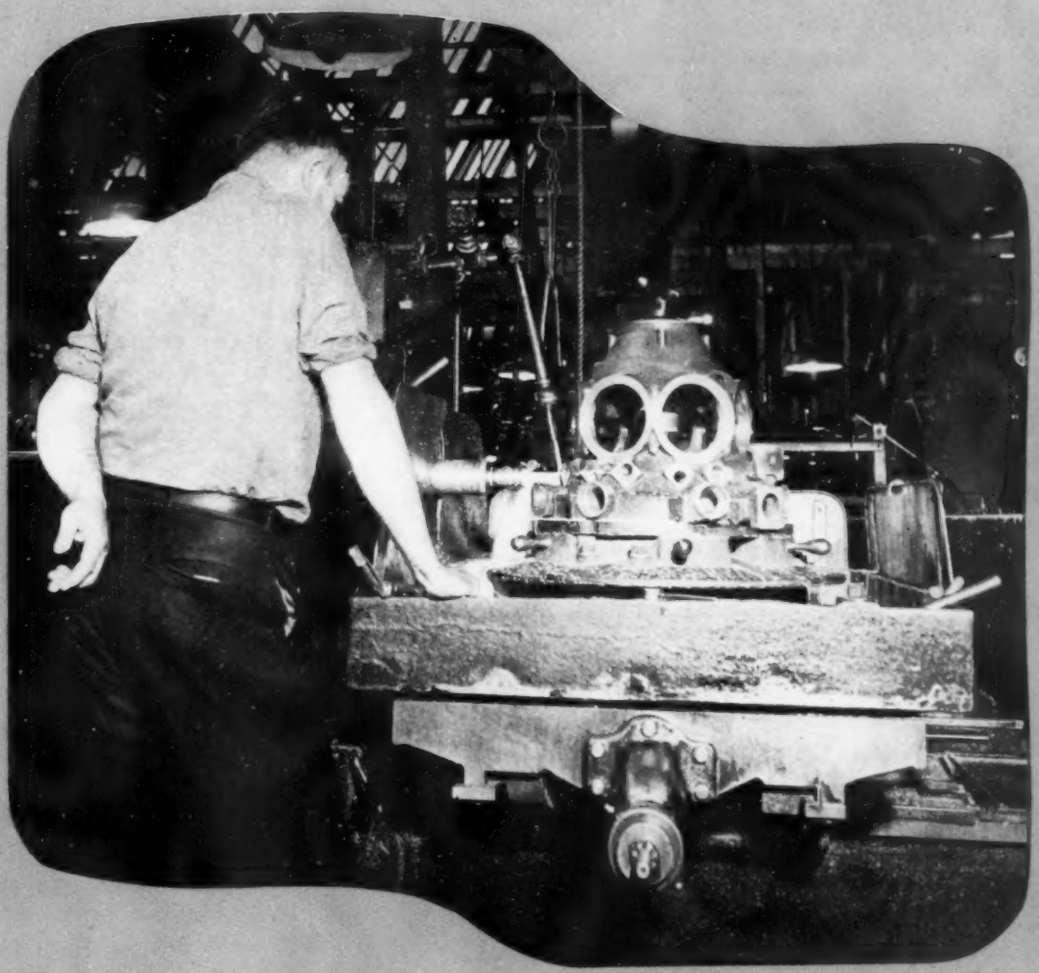
BY JEROME GROSSMAN

A method for stopping a countersink from chattering is described by F. S. McGibbon (*AM*—Vol. 86, page 1094). In this method a thin piece of sheet metal is placed around the countersink, leaving only three teeth exposed, the tool is brought in contact with the work and revolved slowly. In three revolutions the chattering stopped and the band could be removed.

In our shop we often accomplish the same thing by just using a piece of cotton waste in the same manner, but it does not have to be located as accurately.

Armament

SECTION OF AMERICAN MACHINIST



During intermediate expansion stages, a hand-indexed fixture applied to a Lucas mill gave satisfactory production when boring the valve tappet holes in the crankcase

Tank Engines Made on Converted Equipment

also

Conveyors Save Space in Aircraft Plant

Tank Engines Made on Converted Equipment

BY THOMAS F. ROGAN

Vice-President in charge of Aircraft Engine Production, Continental Motors Corporation

TWO YEARS AGO the Continental Motors Corporation signed its first production contract for aircraft engines adapted to installation in tanks. The corporation's first experience in the manufacture of tank engines was gained in working on educational orders in 1936–38 to adapt its seven-cylinder aircraft engine to tank drive. In 1940 Continental achieved a 20-fold expansion of tank-engine production—entirely at its own expense.

Existing equipment was used at the start of the program, yet during the first year the company purchased $750,000 worth of new equipment to boost output. Besides this accomplishment, Continental has financed a further expansion. Beyond this stage, all further expansion programs have been government financed. A few months ago the company announced that it would voluntarily reduce the cost of engines on contracts then outstanding, with the result that the government will save $40,000,000.

As production grew in the consolidated plant, more and more existing machinery was taken from commercial enterprises. Volume by early 1941 did not justify complete production lines for many parts. Operations were performed on lathes, turret lathes, conventional millers, drill presses and ingenious adaptations of old horizontal mills. There were few automatics.

Gradually straight-line production was evolved, and the entire plant is now being placed upon that basis. The first parts to be put on a line basis were the crankcase, accessory case, cylinder head, barrel, piston, link rod, master rod and crankshaft. Production lines were later set up for cams, cam assemblies, pump bodies and oil pumps. Yet in many of these lines, machines still are used to perform several operations by exchanging simple fixtures.

For all of the successive expansion programs it was necessary to consider installed equipment when purchasing additional units. In some cases, service and repair considerations dictated the purchase of like units. In others, it was possible to install high-production and even special-purpose machinery, pro-

Prior to installation of a multi-spindle Natco, this elderly American radial drill served to drill and ream the bolt holes and mounting-lug holes one at a time in the rear crankcase section. A trunnion-type fixture embodied work-locating points and drill bushings

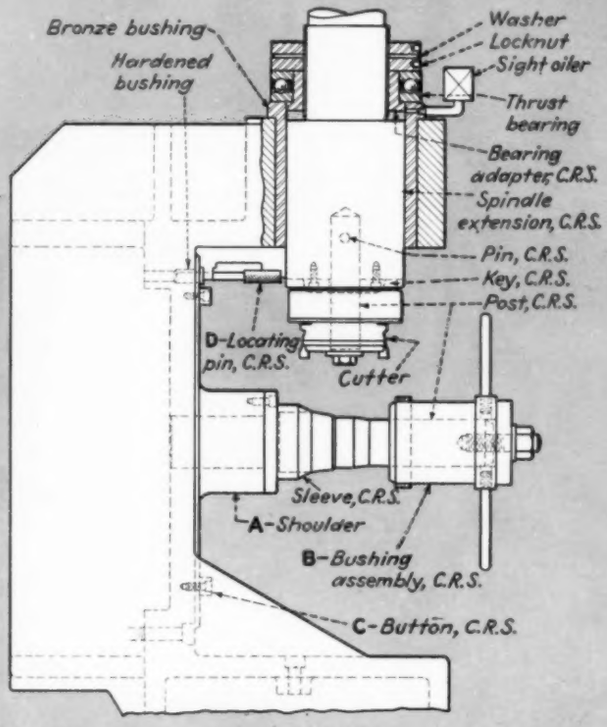
vided that displaced machinery could be put to work elsewhere. Very few old machine tools have been discarded. If dropped from one operation, the machine is listed in the Surplus Machine Record, to which constant reference is made by process engineers.

No new machines are ordered by guess or to anticipate problematical large increases in schedule. The rule followed is that the time per piece and the production per day of the new unit must be studied before specification. As the result of these practices, the score as of a recent date was: 740 old machines in operation; 60 new machines installed or on order.

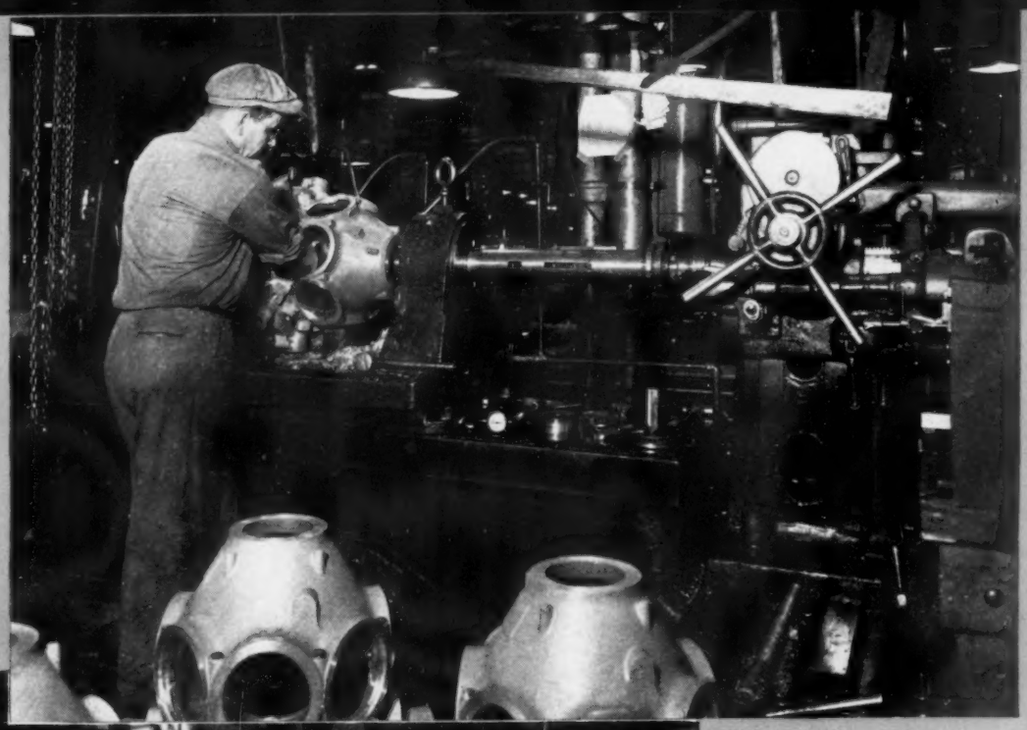
Several Bullard vertical turret lathes are permanently tooled for the first three operations on the crankcase rear section. Only two of these machines were purchased for the line, the remainder were available orginally for the engine project or taken from the automotive parts division. Operations performed on these machines are: (1) machine the front contact face, (2) face and bore the accessory contact face, the bearing hole and the front oil groove, and (3) face inside of the web for crankshaft clearance.

The sharp increase in production quota recently demanded brought about an interesting change in method for drilling and reaming the bolt and mounting-lug holes in the rear crankcase section. Formerly

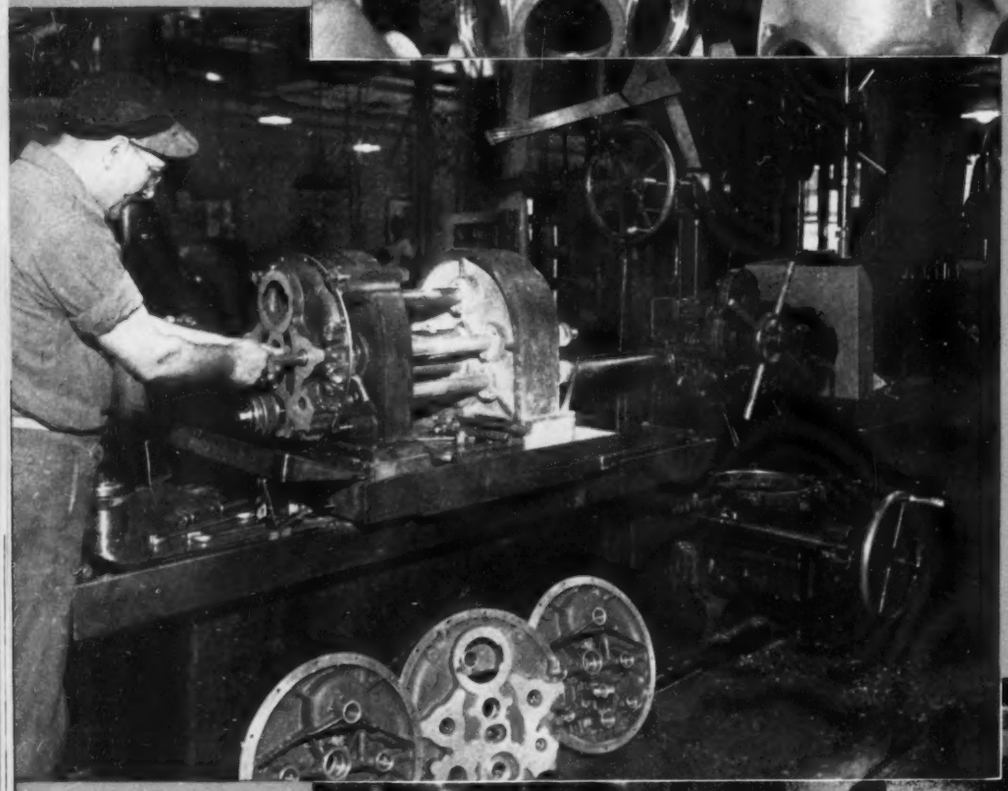
A veteran from the Rock Island Arsenal, this Baker drill was fitted with a heavy fixture with ample locating and tool-guiding means for boring, facing and chamfering the cylinder contacts in the crankcase assembly



Location of the crankcase assembly in the fixture for machining the cylinder contacts is attained with the shoulder *A* and sleeve *B* engaging the bores, the rest pins *C* bearing against the finished face of the rear section, and a locating pin *D* that enters reamed locating holes in the rear section as the assembly is indexed



By exchanging cutters and working to dial-indicator and plug gages, the three main bores in the crankcase assembly are line bored upon an old Rockford horizontal machine. Rough and finish cuts were being taken in this set-up



Some of the few Potter & Johnstons on hand prior to the engine contract were tooled up for machining the combustion chamber, and turning and facing the locating pilot on the cylinder head

To mill the exhaust flange, which lies behind the valve cover box, two old Leland-Gifford profilers turned out thousands of cylinder heads prior to installation of a Cincinnati automatic machine to boost schedules

it was necessary to drill both the rear and front crankcase sections twice so that the holes would match and permit assembly with a locating pin. The old method consisted of first drilling a locating hole under an upright drill and then transferring the part to a trunnion fixture at a radial drill. Here the bolt and mounting-lug holes were drilled and reamed one at a time. The new processing layout calls for two Natco multiple-spindle machines that will respectively drill and ream all bolt holes and mounting-lug holes in both the front and rear crankcase sections. There will be no need for a second drilling operation to insure that holes in the two parts match. The radial drill displaced by this move will be shifted to another point in the crankcase line.

Old Machines Do Precision Work

Precision operations upon the assembled crankcase provide apt examples of how over-age machine tools can be applied to production of munitions in limited quantities, and how such equipment can still serve for roughing operations when schedules are expanded. The secret lies in building precision into the fixture.

The more important operations upon the assembly were performed in this order prior to the expansion toward high-production levels:

Rough face and bore the cylinder contacts one at a time in a Baker upright drill dating from 1906 at least. An exceptionally heavy fixture, incorporating close-limit gaging means and a journal for the boring bar, was designed. The assembly is slid over a post that engages the bore in the front-crankcase section, and a nut is screwed down so that the finished face of the rear crankcase section bears against rest pins in the rear section of the fixture. For angular location of the assembly, to bring a cylinder contact under the multiple-cutter boring and facing tool, a gaging pin is inserted through the locating holes previously finish reamed on an American radial drill.

Next, the three crankshaft-bearing holes were line bored in rough and finish stages on a Rockford hozizontal boring machine. In this case also, the fixture is made exceptionally heavy and is provided with a journal to guide the boring bar. Finish boring, facing and chamfering of the cylinder contacts on another Baker upright completed the precision operations upon the part.

When schedules were expanded, equipment was shifted around in this manner:

The Baker machine used formerly for finishing the cylinder contact face has been moved up to the roughing operation. Rough line boring is continued on Rockfords. Finish line boring is now handled on a Heald Bore-Matic, and the same kind of precision boring machine is used to finish bore, face and chamfer the cylinder contact.

In succeeding operations, the expansion of output has absorbed surplus upright drilling machines. Some of these units do as many as four operations—spot facing the tappet bosses is an example—by exchanging fixtures.

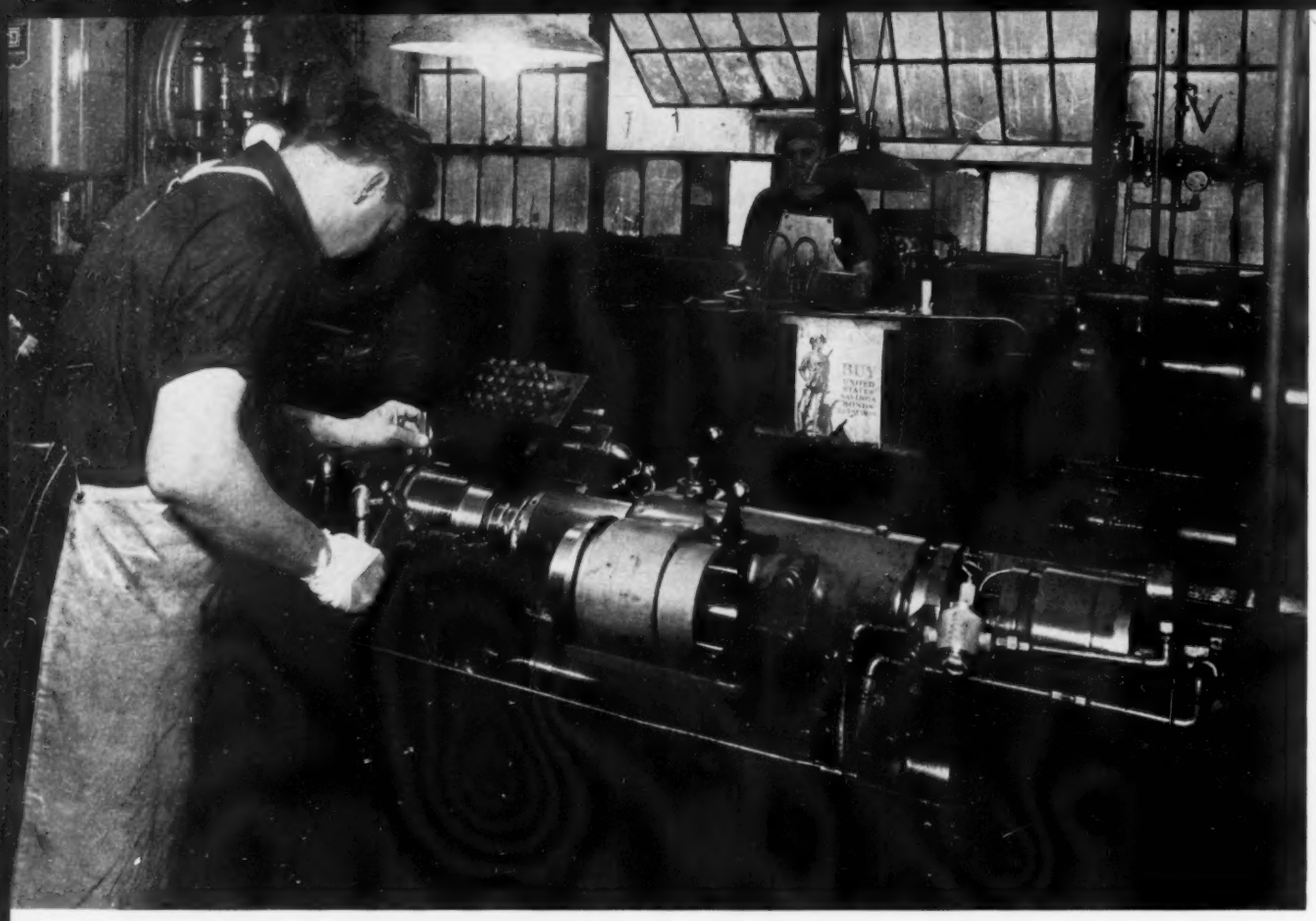
Cylinder-head processing methods have been revised a number of times to keep pace with expanding requirements. After chamfering the valve-insert holes in the casting on a drill press, the cylinder head moves to a battery of old turret lathes for boring and reaming two locating holes and turning three fins.

When low production was the rule, the combustion chamber was machined and a locating pilot faced on Potter & Johnstons. Quota increases required installation of Bullard Mult-Au-Matics to carry much of the production load, and some of the turret lathes were shifted to the master-rod line.

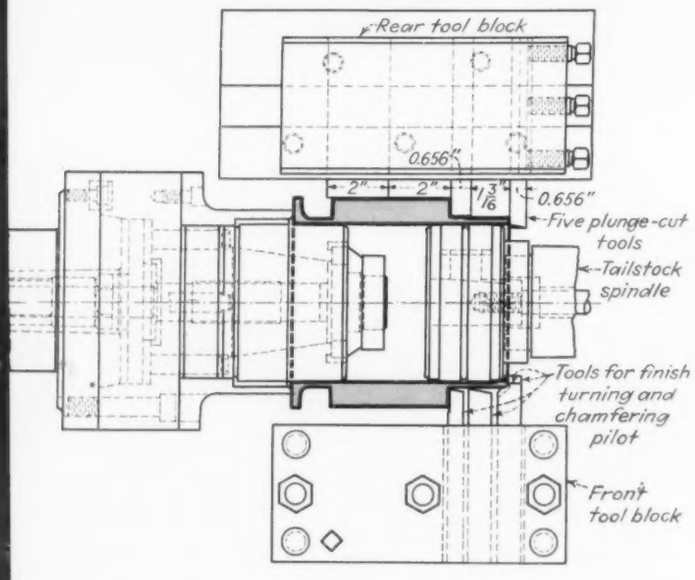
Profile milling of the intake flange was originally done by two old Leland-Gifford hand profilers. To boost production on this operation an automatic Cincinnati profile milling machine has been ordered.

After milling the exhause flange, the cylinder head progressed to a battery of upright drill presses for drilling, reaming and counterboring the spark-plug holes. One of the special-purpose machines added in the latest expansion program is a Rehnberg-Jacobson multi-station machine that will eliminate four single-spindle drill presses and a hand tapping operation.

Substitution of an indexing fixture for the turret permitted this old lathe to machine the valve holes and the valve-insert holes in the cylinder head. Holes are drilled, reamed and spotfaced by tool bars driven by the headstock collet and guided by bushings adjacent to the workpiece. To counterbore and chamfer, tool bars pass through the work to the collet



Since the Fay automatic used for turning the pilot end and the fin section of the cylinder barrel was not equipped to traverse the rear tool arm, plunge-cut tools were worked out for roughing a 5¾-in. wide cut



Roughing of the cylinder barrel pilot and fin section is done by the rear plunge-cut tools. Finish turning and chamfering the pilot are handled by the front tool block, which can be traversed

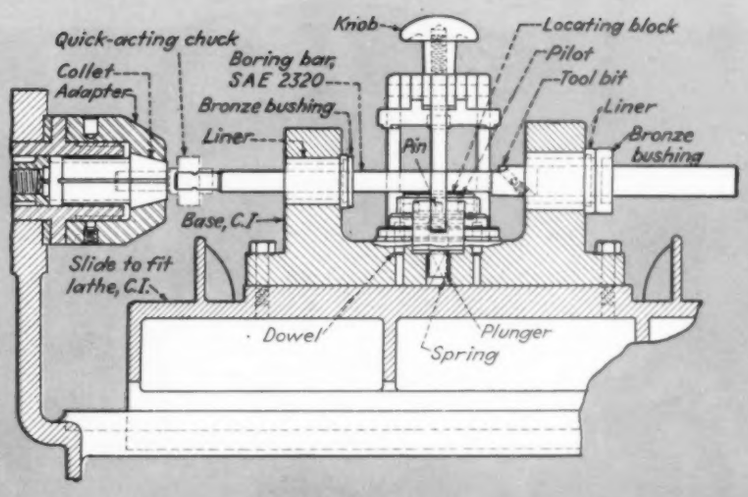
Intake-port holes will still be bored on a Cincinnati 20-in. drill press. Rocker-box cover seats are milled on a Cincinnati No. 3 equipped with a special head having the two spindles located at the proper angles.

Valve guide and insert holes in the cylinder head have been machined on old turret lathes, the fixture taking the place of the turret. Tool holders are gripped in the air-operated collet of the machine and the fixture fed to depth by engaging the saddle feed. Pilots in the fixture provide proper alignment for the toolholders. The method is slow because four tools must be exchanged to handle faces on the exterior and interior of the casting, the latter requiring a back-facing type of tool. Hence, the plant is installing a special Rehnberg-Jacobson multiple-head machine to machine the two valve guide holes and the two insert holes in one cycle, displacing nine turret lathes for possible use elsewhere.

Single-spindle drills have been used to drill and ream the rocker-arm shaft holes in the cylinder head. To increase production a series of Leland-Gifford heads will be mounted on a suitable base and operated in sequence manually. Only one fixture will be needed. Moreover, the operations of drilling, reaming and spot facing the push-rod housing hole (formerly done separately) will be added to the projected multi-head set-up.

Trouble was experienced in equalizing the stud holes in the pads for the rocker-box covers when drilling in low-production setups under single-spindle equipment. To overcome this difficulty and increase production, two multi-spindle drillheads will be mounted on a base provided with a fixture that will

By engaging the carriage feed, the toolbar gripped by the headstock collet is caused to perform one of the operations required to machine the piston wristpin hole



For machining the wristpin hole in the piston, toolbars are passed through guide bushings in the fixture, which replaces the turret on an old Acme turret lathe

permit sighting the rocker-box cover pads when locating the piece.

About six single-spindle drilling machines are to be replaced by a three-way Natco drilling machine that will drill the exhaust flange holes, the intake flange holes and a conduit hole. No change is contemplated in the method of producing the thread for the cylinder barrel. A line of Hall Planetary thread millers will be augmented to cope with production now demanded.

Cylinder barrels are purchased in the rough-turned and heat-treated condition. Machining lines on this engine component have gone through three expansion programs, tending progressively toward high-production equipment on bottleneck operations. The first expansion program required a turret lathe or engine lathe here and there, usually from plant stocks. A few automatics were added to cope with the second boost in quota. Since the third expansion was of major importance, more automatics were added

to the line and special-purpose drills displaced single-spindle equipment.

Turret lathes were used originally for rough boring, turning the outside diameter at the flange end, facing the flange and turning a pilot on the cylinder barrel. To cope with the sharp increase ordered in production of barrels for engine output and service requirements, a number of Bullard Mult-Au-Matics have been installed.

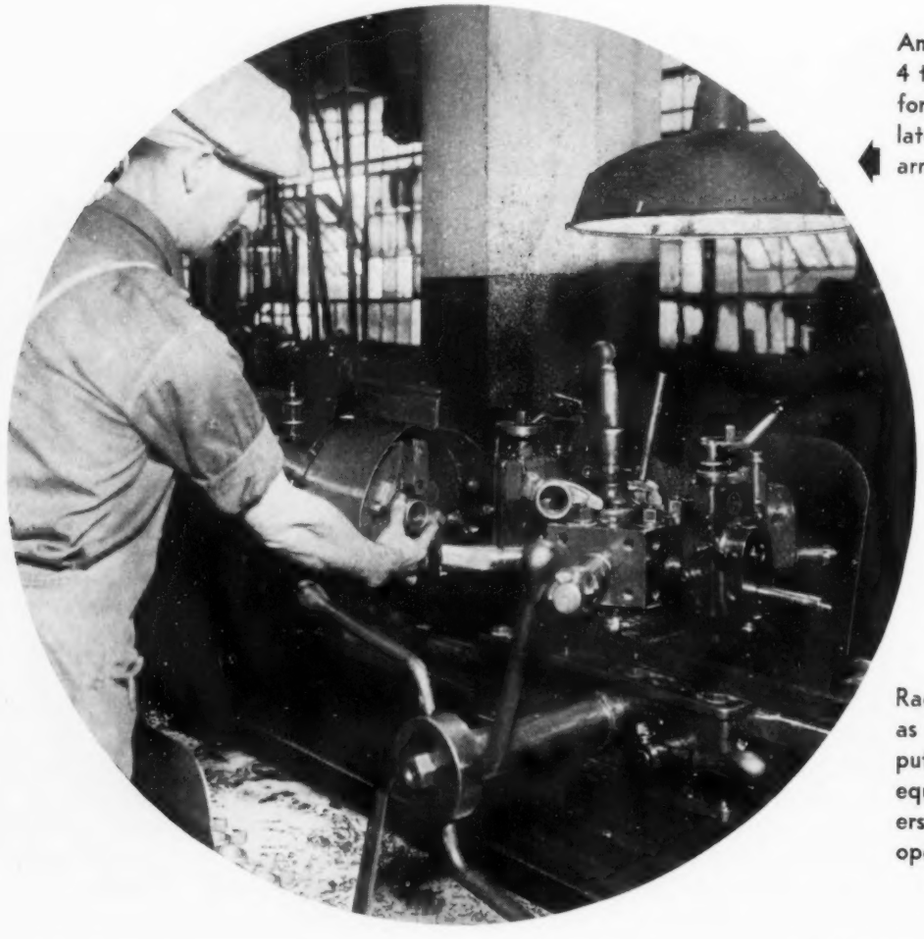
Application of Kennametal or Vascoloy Ramet carbide tools to turning the balance of the cylinder barrel outside diameter has so increased production that the subsequent operation—finning—became a bottleneck. Output on the turning operation was increased from one barrel in 11 min. with high-speed steel tools to one barrel in $2\frac{1}{2}$ min. with Kennametal carbide tools. Since the back arm on the machines was not cammed to traverse across the wide section in which fins are cut, a shaving tool was worked out to handle the $5\frac{3}{4}$ in. total width in a plunge cut, using 0.011 in. feed.

Finning is done in the conventional manner on Fay automatics. The cylinder barrel is not hardened, as is the case with high-output types of aircraft engines. This circumstance permits utilization of Hanson-Whitney thread millers that the plant had on hand. To bolster the production line, thread grinders were specified to avoid trouble with deliveries of thread milling tools.

Many thousands of dollars worth of tools are saved each month by extensive salvaging operations. When finning tools are worn down too short for further use, two of them are held end to end in close alignment in a simple box fixture and torch welded together.

Continental made good use of converted turret lathes to machine aluminum pistons. For operations on the wristpin hole, a fixture was substituted for the turret, and toolbars were driven in succession by the headstock collet after pushing them through the workpiece and guide bushings in the fixture. Rough boring was done with a four-flute tool; semi-finish and finish boring with single-point carbide tools. Following these operations the hole was line reamed.

Piston turning and facing operations were placed on old equipment. Production averaged 20 pieces per grind with high-speed tools. Substitution of Ramet carbide tools boosted tool life to 6,000 pieces per grind, and greater production was achieved through speeding up the machines.



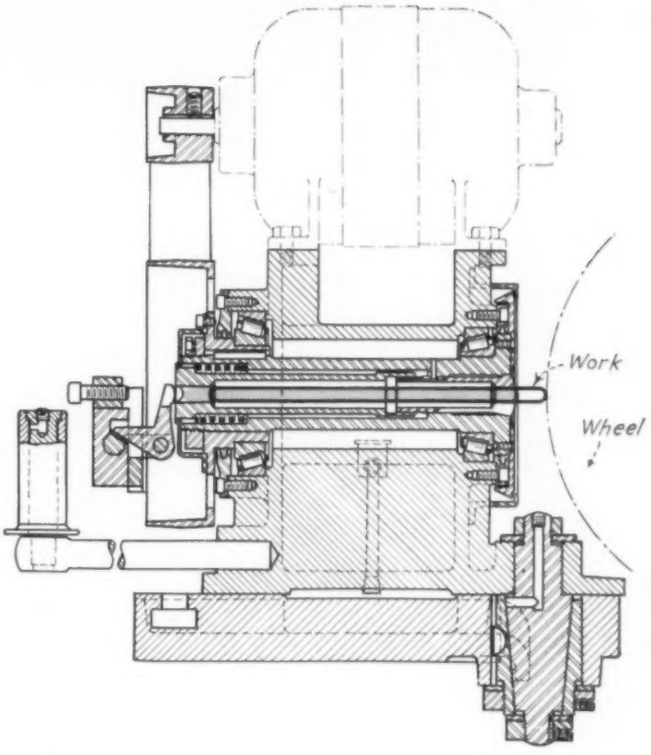
An old Warner & Swasey No. 4 turret lathe was tooled up for finishing the bore and related surfaces in the rocker arm, a part required in considerable quantities

Radius grinding of such parts as valve push rods has been put on a production basis by equipping old Landis grinders with a swiveling power-operated workhead incorporating a collet chuck

Each seven-cylinder radial engine requires fourteen rockers arms. Even with low-quantity production a line was established because of the quantities of rocker arms involved. First operation consists of drilling out the main hole to remove stock, after which the part is transferred to a turret lathe.

Operation sequence on the old Warner & Swasey No. 4 turret lathe consisted of: bore to $1\frac{7}{16}$ in., counterbore $1\frac{5}{8}$ in., undercut, finish front and rear faces, chamfer and finish bore to 1.643 in. This operation is being shifted to a New Britain-Gridley which will have a production rate five to six times as great, although the turret lathes will be retained to bolster the production load and handle service parts. Third operation on the part consists of straddle milling the end and milling a slot for the roller; machines for this work will not be changed.

A number of high-production parts require ball ends. For example the radius on each end of the valve push rod must be held to 0.00 in. and a good finish to achieve an oil seal. Continental found the answer to such radius-grinding operations in the fitting up of old Landis grinders with a home-made swiveling work-head. The operator merely shoves the part into the collet chuck, which is hand operated through a linkage. A motor drive powers the headstock, which is oscillated by hand.



A link-operated collet chuck in the Continental-designed workhead for radius grinding of small parts permits rapid loading to a definite stop

CONVEYORS Save Space in

BY FRANK M. BATES
Chief Plant Engineer, Fleetwings, Inc.

The area required for finishing operations on sheet-metal parts is reduced by installing conveyor systems which use the space near the plant ceiling

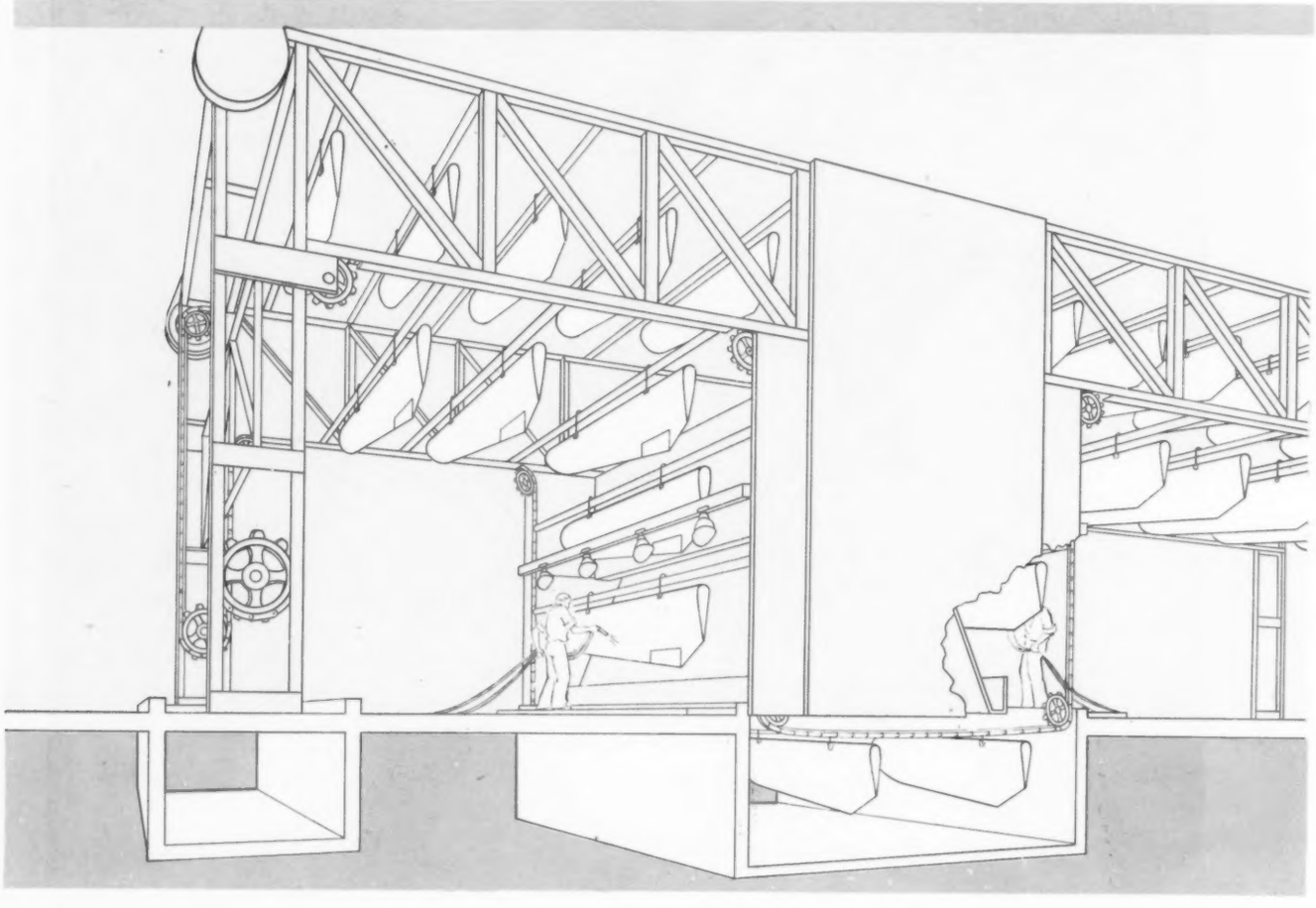
WHEN FLOOR SPACE is at a premium, and up is the only direction left to go, it takes some tricky handling to get good production on sheet-metal parts and assemblies.

In increasing production seven times over in the past year, Fleet-wings, Inc., had to solve the same problems which every aircraft manufacturer has in finishing huge quantities of detail sheet-metal parts and assemblies of comparatively light weight but of large area.

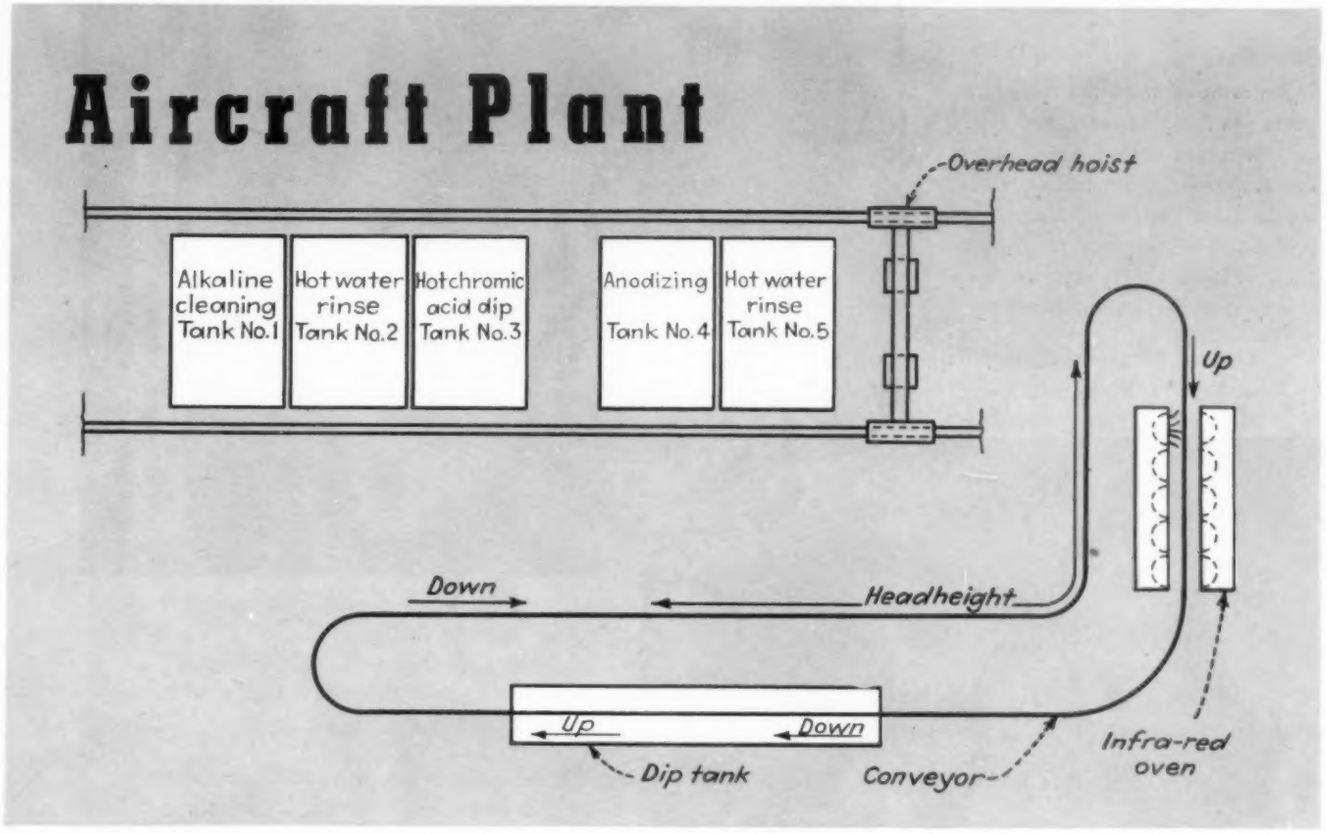
Detail aluminum alloy parts require protective coats of primer before going into final assemblies, metal assemblies require protective coatings and, finally, fabric coated surfaces require doping. Drying time runs from a few minutes for finishing detail parts to three days for drying doped surfaces. The number of coats, length of drying time, the size and number of parts caused large amounts of floor space to be used.

Detail parts originally were laid in wire racks for spraying. Since presses could turn out parts quickly, racks of parts under production pressure accumulated rapidly and used up floor space at an alarming rate. Similarly, fabric surfaces were laid on trestles for spraying, and the three-day drying time created a space bottleneck in the doping room.

Since all Fleetwings' departments had grown to the point where there was no more floor space avail-

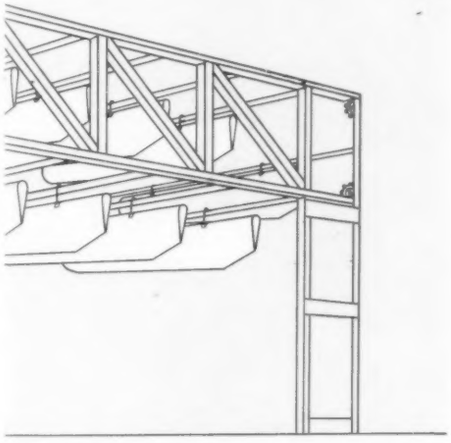


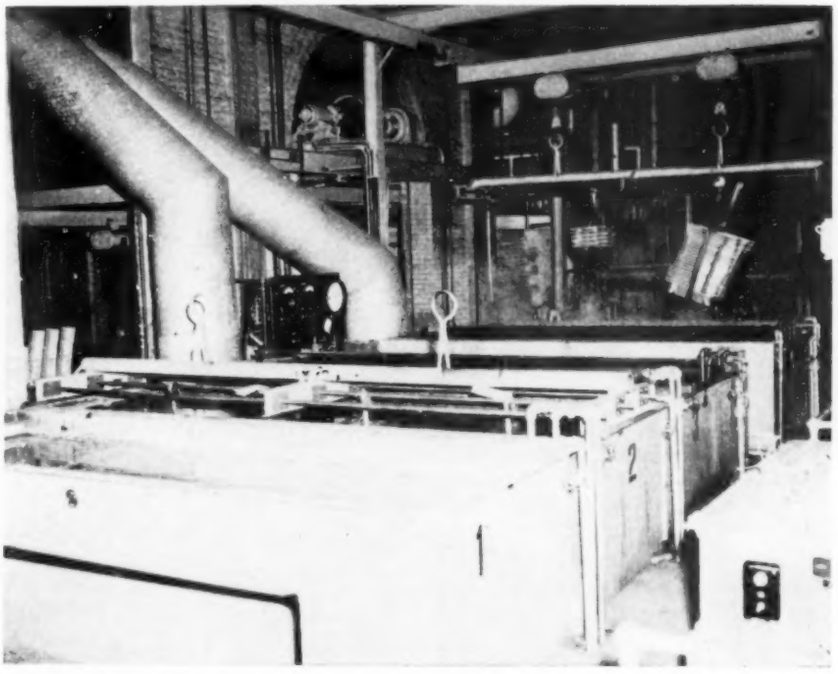
Aircraft Plant



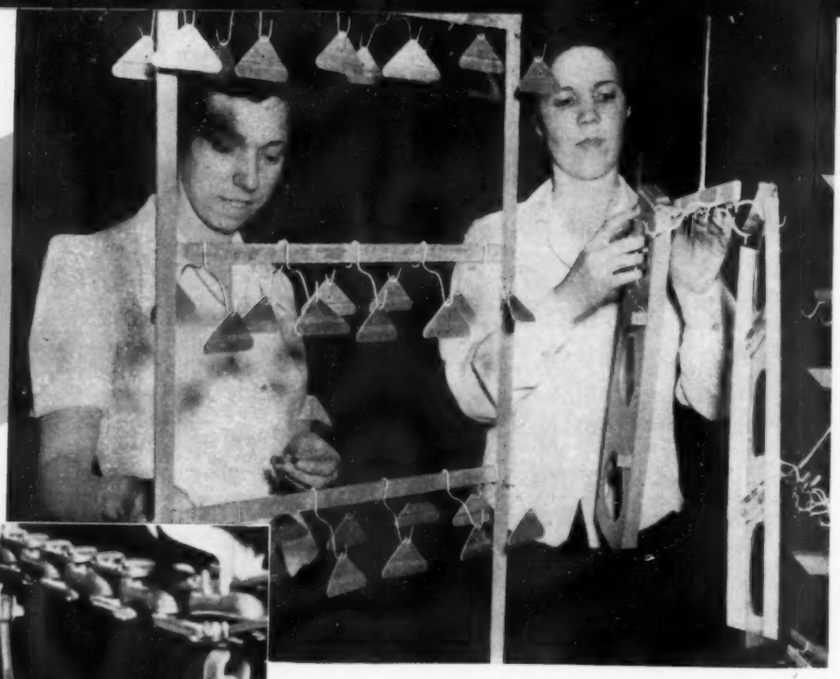
A compact arrangement of cleaning, anodizing, chromatizing and primer dip tanks is possible with a single track conveyor

Schematic arrangement of the doping room shows double spray booth arrangement and storage and drying possibilities gained by utilizing waste space near the roof

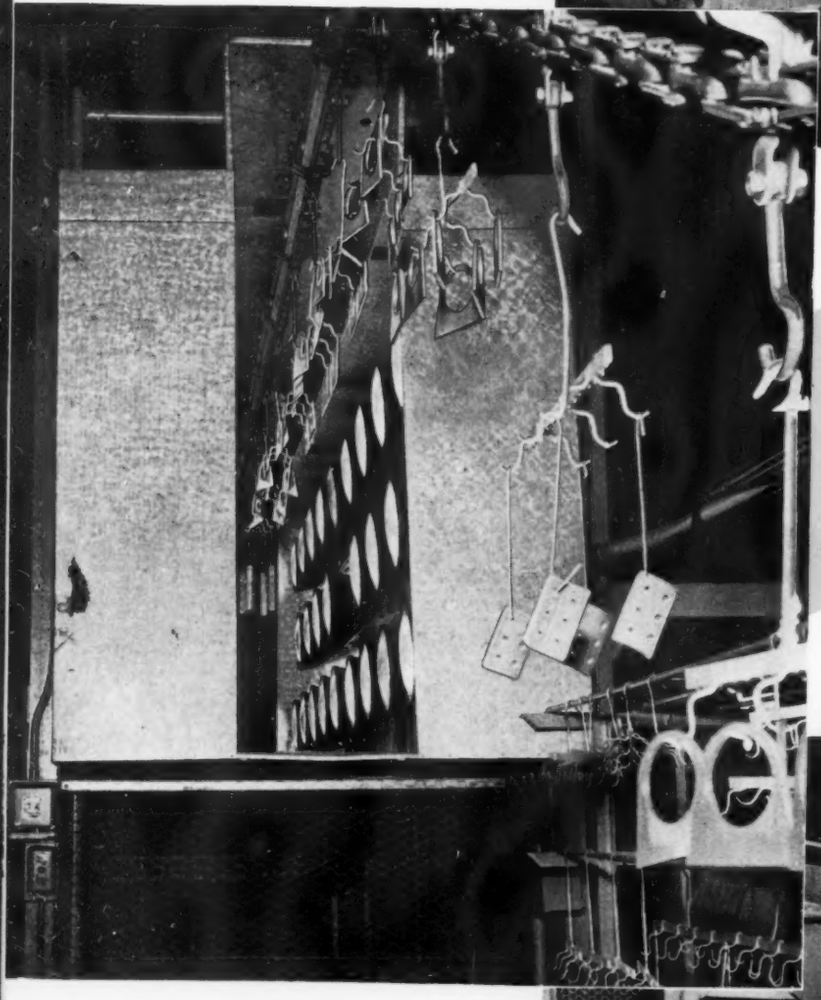




Detail parts which have been stamped and formed are cleaned and anodized or chromatized in these tanks prior to application of the primer. The frame and copper bars from which parts are suspended can be seen on the second tank. This frame is moved from tank to tank by a 1/2-ton tandem hoist



Upon removal from the rinse tank, parts are hung on racks, two types of which are shown here. Parts are suspended from tooling holes, or, in some instances, from holes pierced especially for this operation. Hooks are spaced to keep adjacent parts from touching



This infra-red oven drys moisture remaining on the parts after rinsing. It has 28 1,000-watt Hall reflector type lamps on each side in a tunnel of galvanized sheeting. These provide sufficient heat to dry the parts thoroughly. Hooks which carry the racks are held on a chain powered by Link-Belt drive

"Saveall" safety fuses suspended above the dip tank release a safety device on the fire extinguisher in case of fire so that carbon dioxide pours into the tank from pipes laid along the top edges. An overflow pipe with built-in dams carries excess liquid into sewer, prevents the spreading of fire. Safety lids close quickly to smother flames

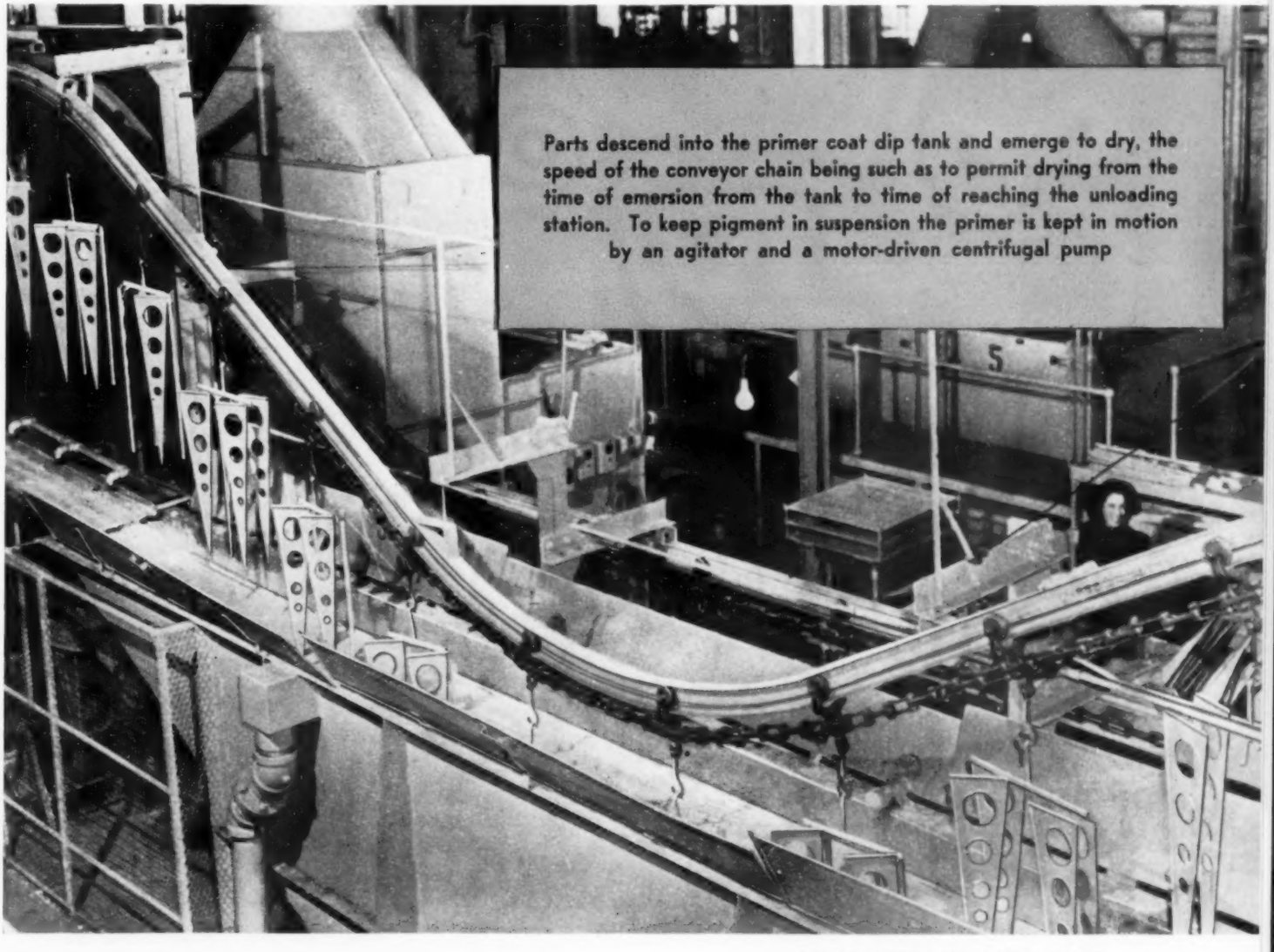
able, it was decided to rearrange facilities and utilize conveyor systems to speed up finishing operations and provide drying and storage space. The latter was obtained without adding to the floor area by utilizing waste space near the roof.

The solution for prime coating detail parts was to use a dip tank for most parts, retaining the spray booths for those which would tend to collect primer in low spots when drying on a conveyor. The arrangement shown in Fig. 1 is capable of handling 6,500 parts per eight-hour day. The sequence of operations which gives Alclad parts a good surface for paint adhesion is as follows:

1. Remove light oils and greases in tank No. 1 which contains a standard alkaline cleaner held at 180 F. If heavy greases or drawing compounds are present, a degreaser is used instead.
2. Rinse in tank No. 2, hot water at 165-170 F.
3. Dip in 5 percent chromic acid solution in tank No. 3, 130 F., for five minutes.
4. Rinse in tank No. 5, water at 200 F. to give a quick dry. For parts which are to be anodized, the No. 4 tank is used instead of No. 3. This is the standard 3 percent solution treatment at 95± 4 F. for 30 minutes.
5. Fans blow water from parts after which they are placed on racks to be carried through an infrared oven for complete drying prior to dipping in the primer.

The dip tank conveyor is driven by a ¼-hp. motor with a 50-1 reduction drive, at a speed of about 12 ft. per min. At this speed, parts emerge from the primer at such a rate that the surface tension gives a smooth coat of primer on the parts. For best results the primer is reduced, 2½ parts thinner to one part primer, before being added to the tank.

A more extensive saving in floor area was made by utilizing waste space near the ceiling in the rooms where control surfaces are primed or doped. Change in arrangements to utilize overhead conveyors gave an increase of several hundred percent in production without increasing floor area.



Parts descend into the primer coat dip tank and emerge to dry, the speed of the conveyor chain being such as to permit drying from the time of emersion from the tank to time of reaching the unloading station. To keep pigment in suspension the primer is kept in motion by an agitator and a motor-driven centrifugal pump

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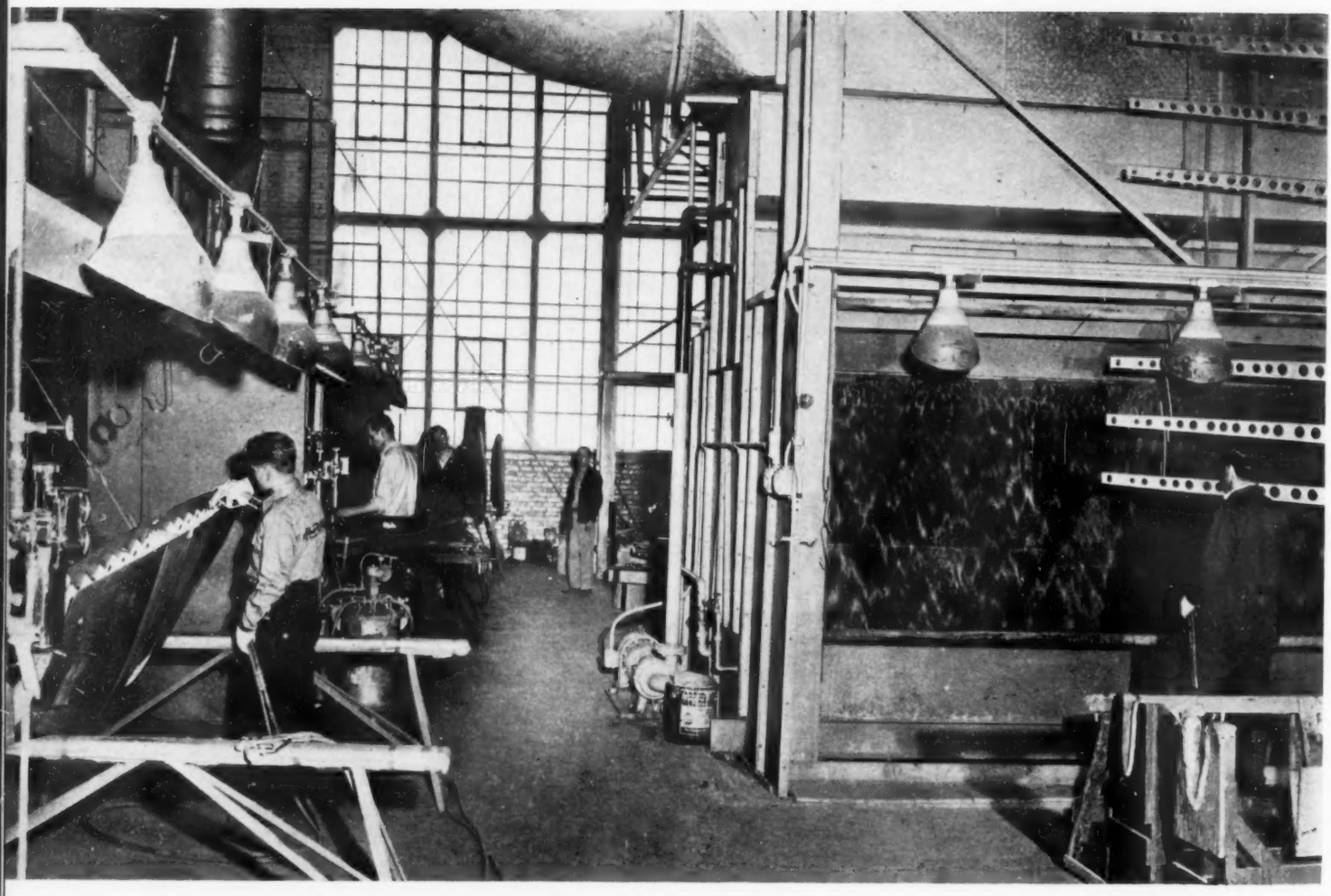
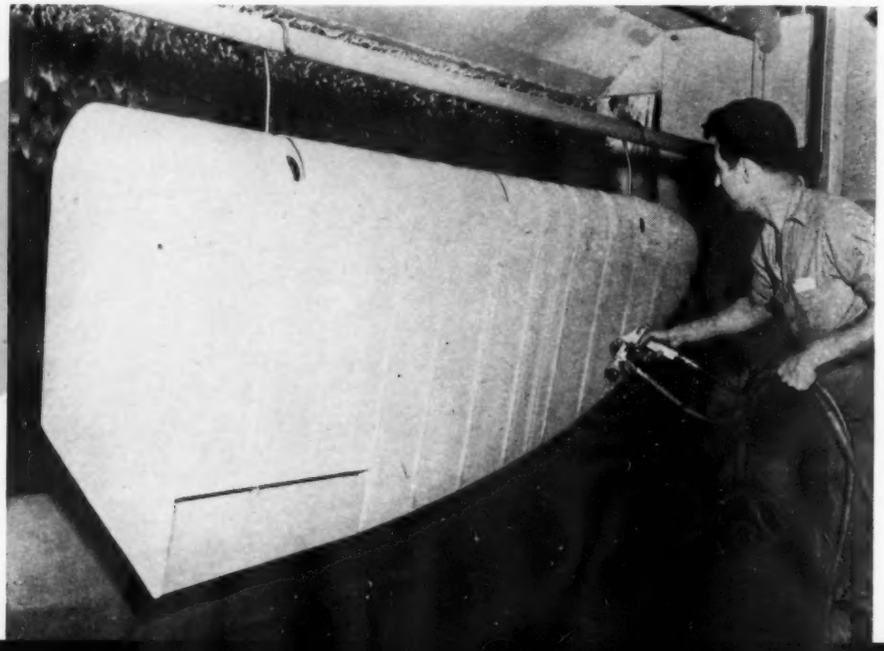
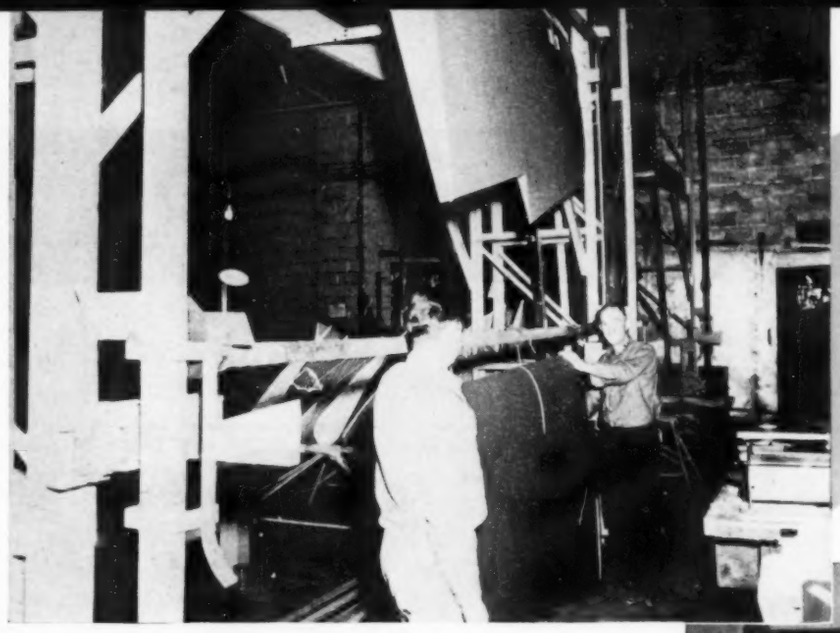
CONVEYORS SAVE SPACE IN AIRCRAFT PLANT



Operator at a DeVilbiss water-fall spray booth at right is spraying prime coat on parts and assemblies which are too large or complex for a dipping operation. Parts move up from the loading station, down in front of the operator at the first spray booth where one side is sprayed, on down into and across the pit in the floor, up in front of the operator at spray booth on the opposite side where the other surface is sprayed, and up along the ceiling where it travels along slowly while drying. This conveyor consists of two chains driven at a slow rate of speed by a single motor and Reeves adjustable speed pulley. The interior of parts difficult of access is handled as shown at the left



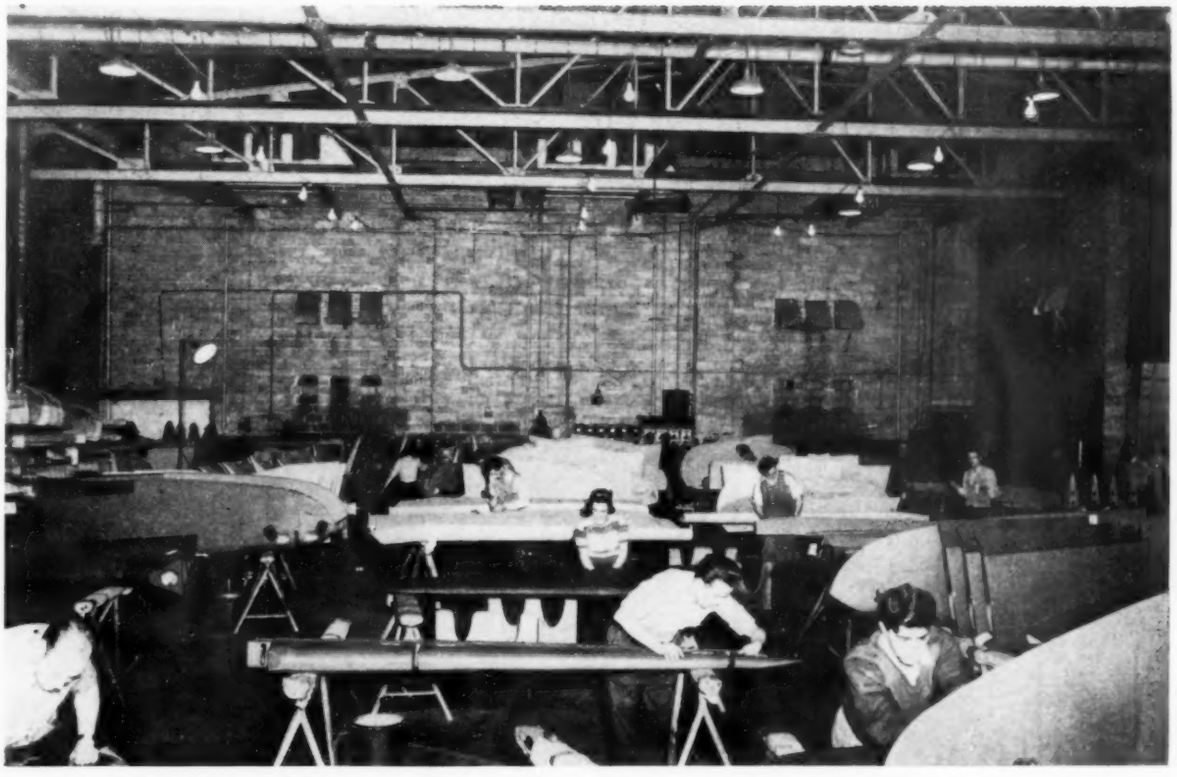
The type of hanging used as well as the type of sprocket used for the conveyor chain is shown in this close-up view. Such spraying eliminates the "flash-over" which occurs when surfaces lay on trestles adjacent to already finished surfaces



After doping, the surfaces go to an adjacent room for a three-day drying period. Parts are hung on bars on an Avey-Ferguson double-chain conveyor similar to those used in the spray room; however, in this case the conveyor travels to the end of the room and back along the ceiling leaving the floor clear for other operations

One end of the supporting bar is shown here in position ready to be picked up by one of the V-shape hangers attached to pivot pins in the conveyor chain

In the early days of the aircraft industry this method of handling parts on trestles was typical. It has been replaced with conveyor systems making more efficient use of the same space. Note in the other illustrations that the space at the top of the room hitherto wasted is now used for drying and storage space



A Positive Stripper for Shells

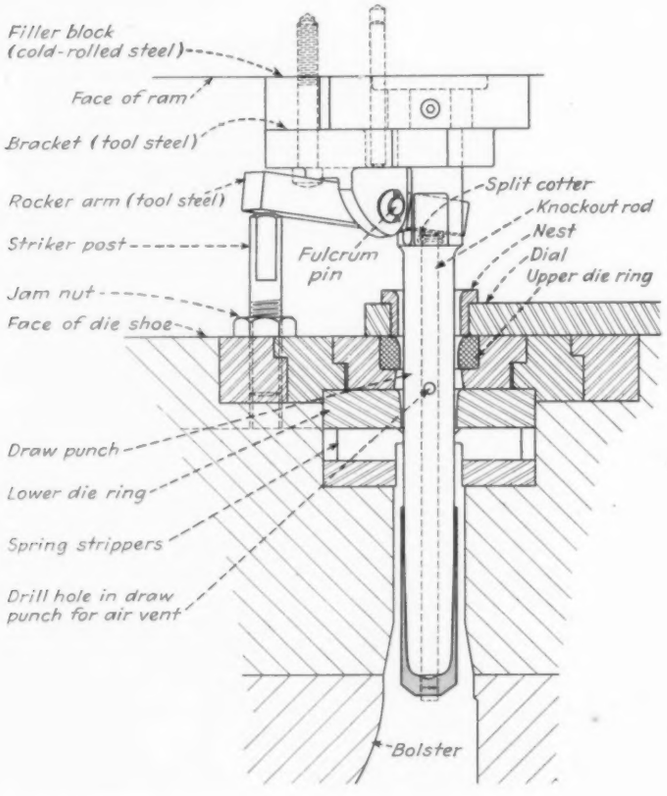
By ROBERT I. MINER
Chief Engineer, Ryerson & Haynes, Incorporated

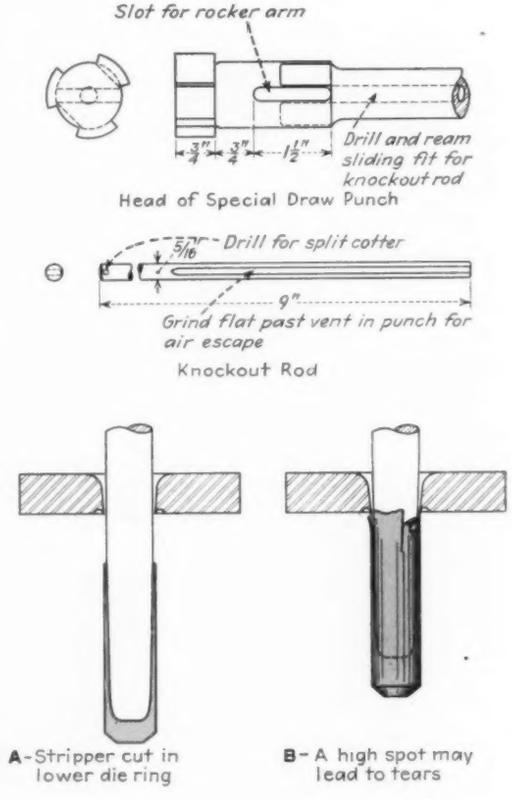
A "KNOCKOFF" MECHANISM, consisting essentially of a knockout rod fitted into the center of the draw punch and actuated by a rocker arm striking a post on the die shoe as the press ram reaches the bottom of its stroke, has been found useful in loosening drawn shells so that they can be stripped effectively by conventional devices. It has particular value where the walls have been drawn so thin as to make conventional stripping difficult, if not impossible.

When thin-wall shells, such as cartridge cases, are ironed past one or more draw rings in the die assembly, there is a natural tendency for the inner walls of the shell to fit closely into the minute crevices resulting from machining and polishing the punch, and for the shell to "hug" that member. Conventional stripping methods, of finishing a sharp edge at the lower edge of the lower draw ring, as shown at *A*, or of incorporating spring strippers in the die assembly, may, by careful fitting and polishing, be sufficient to strip shells satisfactorily if wall thicknesses have been held so uniform in previous draws that the upper edges are fairly uniform in height. However, if a single high spot is engaged by such a stripping device, and must bear the whole load at the start of the stripping cycle, torn or bell-mouthed edges, as shown at *B*, usually result.

The merit of the knockoff device shown in the other drawings lies in its actuation against the relatively stronger base of the shells, thus freeing them from the punch so that they may be stripped with minimum effort by one of the conventional methods. This device is in successful use in the production of 20-mm. brass cartridge cases. It is necessary only to secure movement of the knockout rod through the punch sufficient to "break" the clinging case from the punch. Usually a movement of $\frac{1}{4}$ to $\frac{1}{2}$ in. is sufficient.

Punches and dies should be given a "draw polish", in which the direction of polishing is in line with the punch axis, but even the finest of such polishing does not exclude the probability of the stripping effort being borne by the section of the case where it is least possible to resist the effort of stripping without undue distortion.




Slot for rocker arm
Drill and ream sliding fit for knockout rod
Head of Special Draw Punch
Drill for split cotter
5/16
9"
Grind flat past vent in punch for air escape
Knockout Rod
A-Stripper cut in lower die ring
B-A high spot may lead to tears

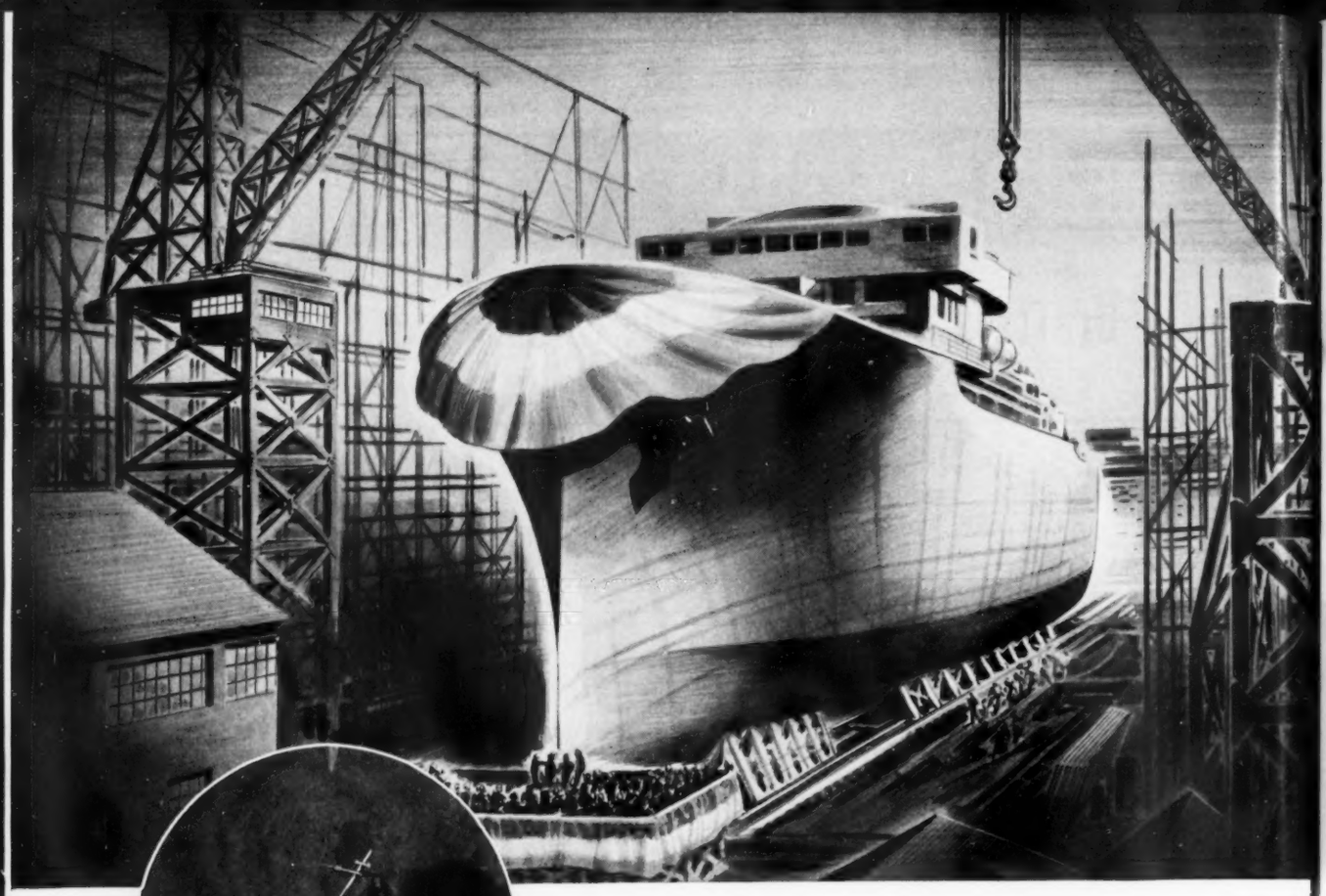
AMERICAN MACHINIST REFERENCE BOOK SHEET

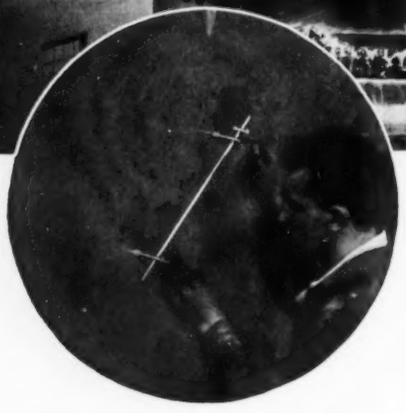
Draft in Inches for Die Clearance Angles—III

BY W. J. WOODWORTH AND P. T. WOODWORTH

Depth	8°	8°30′	9°	9°30′	10°	11°	12°	13°
1/64	.00218	.00234	.00248	.00261	.00275	.00304	.00322	.00361
1/32	.00439	.00467	.00495	.00523	.00551	.00608	.00664	.00722
3/64	.00658	.00701	.00743	.00784	.00826	.00912	.00996	.01083
1/16	.00878	.00934	.00989	.01046	.01102	.01215	.01328	.01443
5/64	.01097	.01168	.01238	.01307	.01377	.01520	.01660	.01805
3/32	.01217	.01401	.01484	.01569	.01653	.01823	.01992	.02165
7/64	.01536	.01635	.01733	.01830	.01928	.02128	.02324	.02527
1/8	.01757	.01868	.01978	.02092	.02204	.02429	.02657	.02886
9/64	.01975	.02102	.02228	.02353	.02479	.02736	.02988	.03249
5/32	.02095	.02335	.02473	.02615	.02755	.03038	.03320	.03608
11/64	.02314	.02569	.02723	.02876	.03030	.03344	.03652	.03971
3/16	.02635	.02802	.02968	.03138	.03306	.03640	.03985	.04329
13/64	.02753	.03036	.03218	.03399	.03581	.03952	.04316	.04693
7/32	.02973	.03269	.03462	.03661	.03857	.04235	.04648	.05051
15/64	.03192	.03503	.03713	.03922	.04132	.04560	.04980	.05415
1/4	.03514	.03736	.03959	.04184	.04408	.04859	.05314	.05771
17/64	.03631	.03970	.04208	.04445	.04683	.05168	.05644	.06137
9/32	.03851	.04303	.04451	.04707	.04959	.05468	.05976	.06494
19/64	.04070	.04437	.04703	.04968	.05234	.05776	.06308	.06859
5/16	.04392	.04670	.04947	.05230	.05510	.06073	.06642	.07215
21/64	.04509	.04904	.05198	.05491	.05785	.06384	.06972	.07581
11/32	.04729	.05237	.05440	.05753	.06061	.06683	.07304	.07937
23/64	.04948	.05371	.05693	.06024	.06336	.06992	.07636	.08303
3/8	.05273	.05604	.05938	.06276	.06612	.07288	.07971	.08657
25/64	.05387	.05826	.06188	.06547	.06887	.07500	.08300	.09025
13/32	.05607	.06171	.06429	.06799	.07163	.07898	.08632	.09380
27/64	.05826	.06305	.06683	.07070	.07438	.08108	.08964	.09747
7/16	.06149	.06538	.06926	.07322	.07714	.08502	.09299	.10101
29/64	.06265	.06772	.07178	.07593	.07989	.08716	.09628	.10469
15/32	.06485	.07105	.07418	.07845	.08265	.09113	.09960	.10823
31/64	.06704	.07239	.07673	.08116	.08540	.09324	.10292	.11191
1/2	.07027	.07472	.07919	.08367	.08816	.09719	.10628	.11543
33/64	.07143	.07706	.08168	.08638	.09091	.09934	.10956	.11913
17/32	.07363	.08039	.08407	.08891	.09367	.10328	.11288	.12266
35/64	.07582	.08173	.08663	.09161	.09642	.10542	.11620	.12635
9/16	.07906	.08406	.08905	.09414	.09918	.10931	.11956	.12987
37/64	.08021	.08640	.09158	.09684	.10193	.11150	.12284	.13357
19/32	.08241	.08973	.09396	.09937	.10469	.11543	.12616	.13709
39/64	.08460	.09107	.09653	.10207	.10744	.11758	.12941	.14079
5/8	.08787	.09340	.09897	.10460	.11020	.12147	.13286	.14428
41/64	.08899	.09574	.10148	.10730	.11295	.12376	.13608	.14801
21/32	.09119	.09907	.10385	.10983	.11571	.12758	.13944	.15152
43/64	.09338	.10041	.10643	.11253	.11846	.12984	.14270	.15523
11/16	.09663	.10274	.10884	.11506	.12112	.13360	.14614	.15873
45/64	.09777	.10508	.11138	.11776	.12397	.13592	.14932	.16245
23/32	.09997	.10841	.11374	.12029	.12673	.13973	.15272	.16595
47/64	.10216	.10975	.11633	.12299	.12948	.14200	.15594	.16965
3/4	.10541	.11208	.11878	.12551	.13224	.14578	.15942	.17314
49/64	.10655	.11442	.12128	.12822	.13499	.14808	.16259	.17687
25/32	.10875	.11775	.12353	.13075	.13775	.15188	.16600	.18038
51/64	.11094	.11919	.12623	.13345	.14050	.15416	.16922	.18409
13/16	.11420	.12142	.12863	.13598	.14316	.15789	.17270	.18759
53/64	.11533	.12386	.13118	.13868	.14601	.16024	.17686	.19131
27/32	.11753	.12709	.13342	.14121	.14877	.16413	.17928	.19481
55/64	.11972	.12853	.13613	.14391	.15152	.16630	.18250	.19853
7/8	.12301	.13076	.13856	.14644	.15428	.17006	.18599	.20199
57/64	.12411	.13320	.14108	.14914	.15703	.17238	.18914	.20575
29/32	.12531	.13643	.14331	.15167	.15979	.17618	.19256	.20924
59/64	.12850	.13780	.14603	.15437	.16254	.17846	.19572	.21297
15/16	.13177	.14010	.14842	.15690	.16520	.18218	.19927	.21645
61/64	.13289	.14254	.15098	.15960	.16805	.18454	.20242	.22019
31/32	.13409	.14577	.15320	.16213	.17081	.18833	.20584	.22368
63/64	.13728	.14721	.15593	.16483	.17356	.19062	.20986	.22741
1	.14054	.14945	.15838	.16734	.17632	.19438	.21255	.23086

STARRETT TOOLS





Making measurements on a ship's propeller fin with a Starrett Steel Beam Trammel.

A Starrett Micrometer on the job in an eastern shipbuilding yard.

STARRETT TOOLS

Are Shortening the Way to the WAYS

One reason your supply house may not be able to furnish all the Starrett Tools you want *when* you want them may be found in the shipyards and marine equipment plants of America.

For there, as on every sector of the production front, you will find countless thousands of Starrett Tools helping skilled hands to do the job better and faster.

The makers of the tools, like the builders of the ships, are bending every effort to meet the demands of the emergency. Should procurement of the proper precision tools prove difficult in your case, bear with us and with our distributor. You may be certain of our intention to deliver Starrett Tools where they will do Uncle Sam the most good.

THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Specifications for Nickel and Nickel-Base Alloy Products

(Tentative Specifications—American Society for Testing Materials)

A.S.T.M. Specification Number	Tentative Specifications for:	Required Chemical Compsition Percent) Ni [a]	Cu	Fe	Mn	C	Si	S	Al	Cr	Form and Condition	Min. Strength, 1000 lb./sq. in. Ult.[c]	Yield	Min. Elong. in 2", %
B 160–41T	Nickel Rods and Bars	99.00[b]	0.25[c]	0.50[c]	0.35[c]	0.20[c]	0.50[c]	0.02[c]	.....	.....	Cold-drawn: Rounds, ¼ to ½ in., incl.	95	75	10
											Rounds, over ½ to 3 in., incl.	85	65	15
											Hexagons, squares and flats	65	40	25
											Hot-rolled: Rounds	65	20	35
											Hexagons, squares and flats	65	15	35
											Forgings, hot-finished: Rounds, hexagons, squares and flats	65	15	35
											Annealed: All products	60	15	35
B 161–41T	Nickel Cold-Drawn Pipe and Tubing	99.00[b]	0.25[c]	0.50[c]	0.35[c]	0.20[c]	0.50[c]	0.02[c]	.....	.....	Soft annealed	60	15	35
											As drawn	80	50	15
B 162–41T[d]	Nickel Plate, Sheet and Strip	99.00[b]	0.25[c]	0.50[c]	0.35[c]	0.20[c]	0.50[c]	0.02[c]	.....	.....	Hot-rolled plate[d]: Annealed	60	15	35
											As rolled	70	20	35
											Cold-rolled sheet: Annealed	60	15	35
											Hard, stress-equalized[f]	90	70	2
											Cold-rolled strip[g]: Annealed	60	15	35
											Hard, stress-equalized[f]	90	70	2
B 127–41T	Nickel-Copper Alloy Plate, Sheet and Strip	63.00–70.00	Remainder	2.50[c]	2.00[c]	0.30[c]	0.50[c]	0.02[c]	0.50[c]	.....	Hot-rolled plate[d]: Annealed	70–85	45 max.	20
											As rolled	80	45	20
											Cold-rolled sheet: Annealed	70–85	45 max.	20
											Quarter hard[e]	78–85	45	20
											Hard, stress-equalized[f]	100	90	2
											Cold-rolled strip[g]: Annealed	70–85	45 max.	20
											Quarter hard	78–85	45	20
											Hard, stress-equalized[f]	100	90	2
B 164–41T (Class A)	Nickel-Copper Alloy Rods and Bars (Class A)	63.00–70.00	Remainder	2.50[c]	2.00[c]	0.30[c]	0.50[c]	0.02[c]	0.50[c]	.....	Cold-drawn: Rounds, ¼ to ½ in., incl.	110	85	10
											Rounds, over ½ to 3 in., incl.	90	70	17
											Hexagons, squares and flats[h]	85	60	25
											Hot-rolled: Rounds, hexagons, squares and flats[m]	80	40	30
											Forgings, hot-finished: Rounds, hexagons, squares and flats	80	40	30
											Forgings, high-tensile:			
											Rounds, 3 to 6 in., incl.	95	70	20
											Over 6 to 12 in., incl.	85	60	25
											Over 12 in.	80	40	30
											Hexagons, squares and flats, 3 to 12 in., incl.	85	60	25
											Over 12 in.	80	40	30
											Annealed: All products	70	25	35
B 164–41T (Class B)	Nickel-Copper Alloy Rods and Bars (Class B)	63.00–70.00	Remainder	2.50[c]	2.00[c]	0.30[c]	0.50[c]	0.025–0.060	0.50[c]	.....	Cold-drawn: Rounds, ¼ to ½ in., incl.	100	75	5
											Rounds, over ½ to 2 in., incl.	80	50	15
											Hexagons and squares	80	50	15
											Hot-rolled: Rounds, squares and hexagons, ½ to 2 in., incl.	75	35	25
											Annealed: All products	70	25	35
B 165–41T	Nickel-Copper Alloy C.D. Pipe, Tubing	63.00–70.00	Rem.	2.50[c]	2.00[c]	0.30[c]	0.50[c]	0.02[c]	0.50[c]	.....	Soft annealed	65	25	20
											As drawn	90	60	15
B 166–41T	Nickel-Chromium-Iron Alloy Rods and Bars	75.00[b]	0.50[c]	9.00[c]	1.00[c]	0.15[c]	0.50[c]	0.02[c]	.....	12.00–15.00	Cold-drawn: Rounds, ¼ to ½ in., incl.	120	90	7
											Rounds, over ½ to 1 in., incl.	110	85	10
											Rounds, over 1 to 2 in., incl.	105	80	12
											Hot-rolled: Rounds, ¼ to ½ in., incl.	95	45	30
											Rounds, over ½ to 3 in., incl.	90	40	30
											Rounds, over 3 to 4½ in., incl.	85	35	30
											Hexagons squares and flats[p]	85	35	30
											Forgings, hot-finished: Rounds, hexagons, squares and flats	85	35	30
											Forgings, high-tensile:			
											Rounds, 3 to 6 in., incl.	100	80	20
											Over 6 to 12 in., incl.	90	70	20
											Over 12 in.	85	35	30
											Hexagons, squares and flats[q]	90	65	20
											Annealed: All products	80	30	35
B 167–41T	Ni-Cr-Fe Alloy C.D. Pipe, Tubing	75.00[b]	0.50[c]	9.00[c]	1.00[c]	0.15[c]	0.50[c]	0.02[c]	.....	12.00–15.00	Soft annealed	80	30	35
											As drawn	120	85	Spec.[r]
B 168–41T	Nickel-Chromium-Iron Alloy Plate, Sheet and Strip	75.00[b]	0.50[c]	9.00[c]	1.00[c]	0.15[c]	0.50[c]	0.02[c]	.....	12.00–15.00	Hot-rolled plate[d]: Annealed[k]	80	30	35
											As rolled[k]			
											Cold-rolled sheet: Annealed	80	30	35
											Hard, stress-equalized[f]	125	90	2
											Cold-rolled strip[g]: Annealed	80	30	35
											Hard, stress-equalized[f]	125	90	2

NOTES:

[a] Includes a small amount of cobalt.

[b] Minimum percentage.

[c] Maximum percentage.

[d] ¼ in. and over in thickness.

[e] Hardness values are included for information only.

[f] A stress-equalizing anneal consists of a low-temperature heat-treatment which equalizes the internal stresses and yet does not completely anneal the material.

[g] ¼ in. and under in thickness, 18 in. and under in width.

[h] Since the finishing temperature in hot rolling is well above the annealing temperature, the mechanical properties of plate in the as-rolled and in the annealed conditions are substantially the same.

[i] No tensile requirements for sheet and strip under 0.020 in. in thickness.

[j] Elongation requirements do not apply to material under 0.125 in. in thickness.

[k] Hexagons to 2 in., incl.; Squares to 2⅛ in., incl.; Flats to 2 by 4 in., incl.

[m] Rounds ½ to 4½ in., incl.; Hexagons to 2⅛ in., incl.; Squares to 2¼ in., incl.; Flats to 2 by 8 in., incl.

[n] Quarter-hard sheets under 0.025 in. and over 0.093 in. in thickness shall conform to the requirements prescribed for cold-rolled sheet in the annealed condition.

[p] Hexagons to 2⅛ in., incl.; Squares to 2¼ in., incl.; Flats to 2 by 8 in., incl.

[q] Hexagons over 2 to 6 in., incl.; Squares over 4 to 6 in., incl.; Flats, width not more than twice the thickness.

[r] For material in the as-drawn condition, the elongation shall be as follows: (1) For wall thickness under 0.062 in., minimum elongation in 2 in. shall be 4 percent for the full tube and 2 percent for a sample cut from the tube; and (2) for wall thickness 0.062 in. and over, minimum elongation in 2 in. shall be 5 percent for the full tube and 3 percent for a sample cut from the tube.

From the beginning of the present emergency it has been New Britain's pledge that our output would not fall short, by so much as a single machine, of the maximum number we are capable of turning out. The Army-Navy E is official recognition that our employees have kept faith with that pledge.

The Army-Navy E is a high honor, but by no means an exclusive one. We are glad indeed that it is to be seen with ever-increasing frequency . . . for we have no wish to be one of but a few who have deserved this recognition.

NEW BRITAIN-GRIDLEY • MACHINE DIVISION • THE NEW BRITAIN MACHINE COMPANY • New Britain, Connecticut

NEW BRITAIN AUTOMATICS

FIRST FOR PRODUCTION IN WAR OR PEACE

Notes on a Triple Shortage

WITH NATIVE VIGOR and enthusiasm most Americans have ransacked their attics, cellars, closets and garages for scrap metal the past few weeks. Manufacturers have cleaned out the nooks and corners of their plants with the same objective.

When really hard pressed, all of us took off our coats and went to work. The result is that steel output has spurted to the highest rate since the war began at a time when curtailment appeared inevitable.

The same sort of ingenuity and cooperative effort shown in the scrap drive should be applied to relieve the three most critical shortages facing America at war: manpower, machines, materials.

Manpower still is long in some communities while short in others. The armed forces must take many men from war shops; at the same time they should return to industry skilled men who can best serve their country there.

In hundreds of war factories men are laboring like beavers to push production. Elsewhere they are drawing big pay for a minimum of work.

Many plants have not yet made even a beginning in employing women or older men. Isn't it about time? And why not lengthen out the work week in war plants where it now is nearer forty than fifty hours? The war effort thus would gain the equivalent of putting several more millions of people to work without actually doing so.

As the President said, "The task is that of having the right number of people in the right place at the right time." It might be added, "With the high resolve to do the best possible job for their country."

Our use of machines in war plants is far short of what it should be. Says one war official, "Only 56 percent of the theoretical 168-hour week is being utilized with respect to a selected list of highly critical types of machine tools." We suspect he is nearly right. Plenty of new as well as old machines are standing idle for one reason or another.

No one familiar with production expects a shop to operate all its machines 168 hours a week or expects all of America's machines to run on that schedule. Several factors make such performance impossible.

Slight excuse exists, however, for the rate of use to be so low as at present. If it stays that low, it is proof that we are taking our war assignments half-heartedly.

Regarding materials, we can do no better than quote a letter from a friend who knows his way around industry and around Washington:

"I am more and more of the impression as I make contacts in Washington that we don't know where our metals are going and that we are producing enough metals to meet our essential needs if we only got more accurate information.

"I think we are contending with human nature in the form of a purchasing agent who protects himself by getting in more material than he must have and the army officer who protects his projects by putting in claims for more material than his projects warrant."

Just as in manpower, the problem in materials is to have the right tonnage in the right place at the right time. If we can distribute available materials on that basis, at least some of the talked-about shortage will disappear.

We can lick our triple shortage problem. The solution isn't in providing more and more men, machines and materials. There is a limit to our ability to do that. The answer is to use our head in making the best possible disposition of the facilities at our command.

Burnham Finney

GAGING BUSINESS

Despite great efforts, machine tools in small shops are used only about 60 percent of the time. Machine tool builders with AA2X rating fail to get sufficient materials, so many war projects rate AA1

Machine Tools Still Idle Though notable progress is being made in getting the metal-working shops of the country onto a war basis, machine tools which could be doing war work around the clock still are idle a good part of the time. In New England alone it is estimated that machine tools installed in machine shops are operating only about 60 percent of capacity based on a 168-hour week. It is believed that this rough figure would apply throughout the United States.

There are good reasons why it is impossible to run all the machine tools of the country on a 24-hour-a-day schedule seven days a week. In the first place, many machines are not adaptable to war jobs and must be counted out altogther. Secondly, hardly a plant exists in which every department and every machine are balanced with all other departments and machines which create the bottleneck automatically limit the work required from less critical machines.

Nevertheless improvement in the use of the country's machine tool facilities is imperative if full production of war goods is to be achieved as early as possible. A little digging here and there for suitable machines to do a specific job and greater cooperation among producers of war items will help to utilize existing equipment to a greater extent and will remove the necessity for building additional plant facilities. Such efforts have been successful among manufacturers of fuzes through the help of the Army's ordnance division.

AA2X Rating Too Low Impending shortages of materials, especially steel, are worrying machine tool builders. The machine tool industry has been given a blanket rating of AA2X, which seemingly ought to enable companies to secure sufficient tonnage to keep production at capacity. The practical working of steel priorities, however, is likely to bring less satisfactory results. So many war projects have an AA1 rating that companies with an AA2X rating will be lucky to get a fraction of what they need. If machine tool builders are to be expected to turn out the machines vital to the war program, they must have a higher rating.

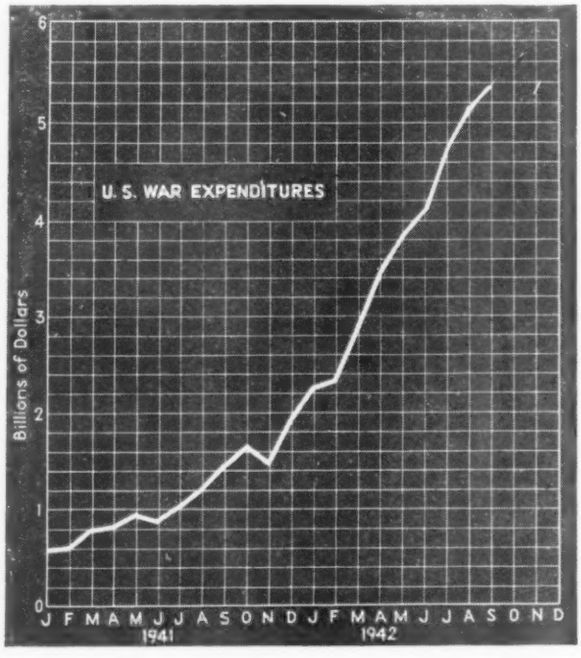
Machine tool production is at a monthly volume of about $130 millions. If it were not for threatened shortages of materials, it could go higher, because new plant facilities have been completed or are nearing completion, thus adding to the industry's over-all capacity. It appears likely that output of machine tools the remainder of this year will stay near the current level.

Industry Favors Heavy Production A subcommittee of the machine tool industry advisory committee of the War Production Board has completed its task of reviewing the future requirements for machine tools in war production. Its report will be made privately to the director of the Tools Division of WPB. It is known, however, that the industry itself is convinced that exceedingly heavy production of machine tools will be imperative during 1943. The backlog of the industry, though declining, is upwards of one billion dollars and new war projects needing new tooling are bound to develop as the progress of the war discloses the necessity for new and improved weapons. Total shipments by the industry this year now are estimated at slightly under $1,400,000,000. Production in 1943 should be higher than in any other year except 1942. The second best year to date was 1941, when machine tools valued at $765,000,000 were built.

The machine tool industry is comprised of such varied types of products that no rule can be laid down to apply to all companies as to war operations. Some companies have order books which will keep their plants busy straight through next year. Others are quoting relatively near deliveries. Each company's position must be arrived at separately and the future demand for its products surveyed. If it won't have enough business to be fully occupied, it will be asked to do work for other machine tool builders who still are in a tight situation. If it still has excess capacity, the facilities of the company will be appraised with the view of using a portion to make munitions.

Washington is eager to guard against any possibility that part of the machine tool industry's capacity might be converted to making other war products and suddenly find that a change in the war situation has brought an unforeseen and real need for a large number of machine tools the building of which thus would be delayed. An influential group of high officials in Washington think it better to play safe by producing too many machine tools than to find out later that the war factories have too few.

Arms Production Mounts Steadily Production of munitions is steadily mounting. Shortages of materials however are acting as a brake on the operating rate in a number of plants which, if plenty of materials were available, would be able to turn out far more goods than at present.



Climbing Steadily— During September war expenditures were $5,384,000,000, according to a preliminary report. Compared with August war expenditures of $5,182,000,000, September showed a rise of 3.8 percent. Total U. S. expenditures since July 1, 1940, now amount to $50,125,000,000.

Methods of Material Control Still Argued

Kanzler's Material Scheduling Plan would leave breakdown to industry, based on Army, Navy orders. Steel Quota Plan would simply divide available material among agencies

BY ROBERT COLBORN

WASHINGTON—Details of the material control scheme which is to replace the Production Requirements Plan sometime next year were, in mid-October, still in dispute. In very bitter dispute, in fact, one of the bitterest that has ever wracked WPB.

The battle, on the surface, is over method. It's now agreed that the "horizontal" Production Requirements Plan, which allots material independently to each plant, no matter where it stands in the chain of production, must be replaced by some "vertical" system which would ensure that a parts plant receives material which will permit a rate of operation geared to that of the plant it's supplying.

On the one side of the dispute is the Material Scheduling Plan developed by Director-General of Operations Kanzler (*AM*—Oct. 15, p. 1192h). Basic element of MSP is assignment to industry itself of the tough job of breaking down master production schedules—so many tanks, so many planes—into the grubby detailed scheduling of parts, accessories, raw materials. When the Army and Navy have decided at what rate they'd like to have production of military end-products, these schedules are to be turned over to the big prime contractors to be broken down into subschedules and to be translated into bills of needed materials.

On the basis of these material estimates, WPB will order the end-product schedules adjusted to fit the material supply. Initially, this cutback will be computed on the basis of the demand-supply situation in steel, steel alloys, copper, copper alloys, and aluminum, on the assumption that if the schedules fit the supply of these materials, there will be plenty of everything else. Then the prime contractors will take hold again and revise the subschedules of production to correspond. These production schedules worked out by the prime contractors, will form the basis on which materials would be allotted to their suppliers.

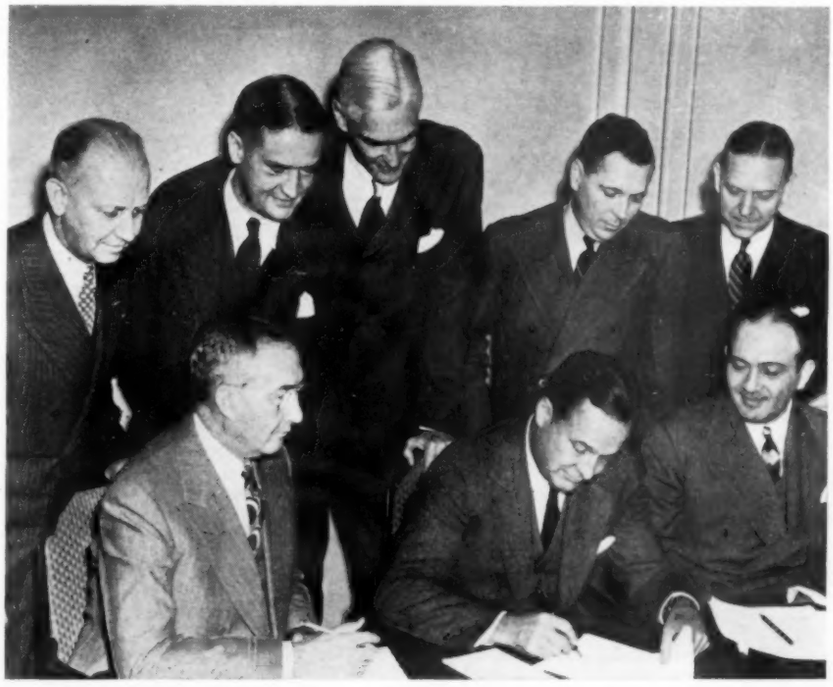
The Material Scheduling Plan would throw great responsibilities on the prime contractors. It would also give them great power; they'd decide the production rates of the subordinate producers clear back to the raw material suppliers. The plan is based on the peacetime practices of the auto industry, was initially brought forward as the "General Motors Plan."

On the other side is the Steel Quota Plan which is being pushed by the WPB Iron and Steel Branch. Under this plan, certificates for steel would be issued, up to the amount of the available supply, to the procurement agencies in proportion to their needs as revealed by production schedules. The agencies would turn over the certificates to their contractors, and orders for steel would only be filled when accompanied by a certificate, and a steel mill could accept any order so accompanied.

The decision—which is up to Nelson and Eberstadt—has swung back and forth. For a while MSP was definitely in; then SQP was substituted; then SQP was out; later in October the issue was in doubt.

It looks like a pretty abstract and technical matter to get excited over. Actually, however, what's involved is a battle between the manufacturing industries, spearheaded by the auto firms, and the raw material producers, with the steel industry in the forefront. MSP would give great power to the big manufacturers in formulating detailed production schedules for all of industry. It would be convenient for them, since once a schedule has been approved there'd be little further paperwork in getting materials.

For the material producer, however, MSP would mean that orders couldn't be placed with them in any scheduling period until the schedules had been completed, a great inconvenience. It would mean that the mills' operations would largely be scheduled by their big customers. And it would put the producers squarely on the spot for any lag in munitions output. Every manufacturer would be telling his friends, "I submitted a schedule for a hundred secret weapons a month but they cut me down to fifty because there isn't enough iron."



Pool Efforts—To attain production as quickly as possible, eastern aircraft manufacturers recently organized Aircraft War Production Council, East Coast, Inc. Seated (l. to r.) are Glenn L. Martin, president, Glenn L. Martin Co., who was elected council vice president; G. W. Vaughan, head of Curtiss-Wright Corp., leader of the movement to organize the council, and elected its president; and Victor Emanuel, president of The Aviation Corp.; Standing (l. to r.) are O. L. Woodson, vice president of Bell Aircraft Corp.; R. S. Damon, president, Republic Aviation Corp.; J. Carlton Ward, Jr., president, Fairchild Airplane & Engine Corp.; L. C. Goad, general manager, Eastern Aircraft Division, General Motors Corp. and George Chapline, vice president of Brewster Aeronautical Corp.

Army-Navy, Maritime Commission Production Awards Made to Group of Deserving Plants

WASHINGTON — Awardings of the Army-Navy "E" burgee and of the Maritime Commission "M" pennant continue to spotlight and encourage the deserving producers of war material. Along with the lapel buttons awarded the employees of the plant, the official "pat on the back" is aiding production through publicly expressing appreciation of a job well done and through developing a spirit of competition between plants and team work among employees. Those winners announced since the publication of previous lists (AM—Vol. 86, pages 916d, 974d, 1042d, 11261 and 11921) are: Atlas Press Co., Allegheny Ludlum Steel Corp. (Brackenridge, Watervliet plants), American Welding Co., Auto Ordnance Corp., Auto Specialties Mfg. Co., Barbour Stockwell Co., Beech Aircraft Corp., Bendix Aviation Corp. (Bendix, Philadelphia plants), Berg Boat Co., Bethlehem Steel Co., Boonton Molding Co., Brunner Mfg. Co., Bucyrus Erie Co. (S. Milwaukee plant), Chapman Valve Mfg. Co., Clarostat Mfg. Co., Inc., James Cunningham Son & Co.

Many Qualify

Divine Bros. Co., E. I. du Pont de Nemours & Co., Edo Aircraft Corp., Fairchild Aviation Corp., General Cable Corp. (Perth Amboy and Rome plants), General Motors Corp. (Allison Div. plant), B. F. Goodrich Co., Gundlach Mfg. Co., Hobart Mfg. Co., Hood Rubber Co., Industrial Tool & Die Wks., Ingersoll-Rand Co., Jacobson & Co., Inc., Jessop Steel Co., Johnson Steel & Wire Co., C. M. Kemp Mfg. Co., Kingsbury Machine Wks., Inc., Kollmorgen Optical Corp.

Leece-Neville Co. (2 plants), Lights, Inc., Mack Mfg. Co., Manufacturers Machine & Tool Co., Inc., Marquette Metal Products Co., New Process Gear Co., Oneida Ltd., Owens-Corning Fiberglas Corp. (Ashton, R. I. and Newark, Ohio plants), Parish Pressed Steel Co., Philco Corp. (Chicago plant), Radiomarine Corp. of America, Remington Arms Co., Inc., Rieke Metal Products Corp., Ritter Co., Inc., W. A. Robinson, Inc., Ross Gear & Tool Co.

Savage Arms Corp., A. Schrader's Son, Scott Aviation Corp., Simpson Optical Mfg. Co., Solar Aircraft Co., Spicer Mfg. Corp., Sylvania Electric Products, Inc., Union Asbestos & Rubber Co., Wyman-Gordon Co. (Harvey and Worcester plants), York-Hoover Body Corp., Body Div., York Safe & Lock Co., Youngstown Welding & Engineering Co.

CHRYSLER CORP.'s Highland Park, Lynch Road, Plymouth, Dodge, DeSoto and Chrysler passenger car plants, Detroit, received the award from Under-Secretary of the Navy James V. Forrestal. Present were Capt. A. S. Wotherspoon, Under-Secretary Forrestal, Chrysler President, K. T. Keller and Rr. Admiral W. H. P. Blandy.

N. A. WOODWORTH CO. employees heard Col. G. E. Strong praise the fair manner in which plant labor troubles had been settled, as he awarded the burgee for producing parts for airplane engines. President Woodworth, Lt. Col. Strong and M. B. Gordon inspect a Nazi-bullet-pounded Wright Cyclone engine which contained Woodworth parts.

WPB to Seize Idle Goods

WASHINGTON—WPB's old Inventory and Requisitioning Branch has been given a new name and a new boss to take on a job bigger than the mere seizing of orphaned export stocks of raw material for which it was originally set up. Now it is the Materials Redistribution Branch and is headed by Col. C. R. Baxter of Army Ordnance.

Its major aim now is to move into war production the big stocks of semi-fabricated goods which for one reason or another are idle in the hands of manufacturers. Commonest cause of idle stocks is a WPB L-order forbidding further production of some lines of goods. Another situation is when a manufacturer finishes a war contract which is not renewed.

Materials Redistribution Branch has major programs underway to recapture such stocks of copper, aluminum, manila rope, magnesium, tin, nickel, white metal, brittania metal and pewter. Next week it will start on its biggest program yet—getting hold of the millions of idle tons of iron and steel—with issuance of about 200,000 questionnaires to possible holders of stocks.

National Metal Congress Devotes Energies To Many Problems of Wartime Production

CLEVELAND — Activities of the National Metal Congress and Exposition, held in Cleveland during the week Oct. 12-16, centered on one theme: "How to do a better job of winning the war." Thousands of industrialists, metallurgists and engineers who attended the technical sessions and the displays at the Public Auditorium returned to their home plants impressed with the seriousness of the production job still ahead of them.

As in recent years, the Congress was jointly sponsored by the American Society for Metals, the American Welding Society, the Wire Association, and the Iron and Steel and Metal Divisions of the American Institute of Mining and Metallurgical Engineers. A feature of the ASM program was a series of victory hours addressed by Rear Admiral Clark H. Woodward, Lieut. Col. E. G. Strong, Central Procurement Office, Army Air Corps, Colonel H. M. Reedall, executive officer, Cleveland Ordnance District, and Dr. Wilbur A. Nelson, special assistant, War Production Board.

Louis P. Lochner, former Chief of the Berlin Bureau of the Associated Press, spoke at the ASM Annual Dinner of October 15. Mr. Lochner's intimate knowledge of Germany before and after the start of the war formed an authoritative background for his discussion of today's wartime needs. He was introduced by Dr. Bradley Stoughton, ASM president and toastmaster at the dinner.

Industrial exhibits at the Auditorium, while lacking in the ornate displays of past years, reflected a genuine interest in new materials, equipment and metal-working processes. As a rule the booths were of moderate size and avoided publicity eye-catchers in favor of practical demonstrations of their products. Because of the scarcity of equipment many companies resorted to photographs of recent installations to get their methods across to the visitors.

The Stewart Industrial Furnace Division, Chicago Flexible Shaft Co., showed a method of heat-treating armor piercing shot. A novel feature of this set-up was a moving conveyor containing a series of cages into which the heated shot are placed point downward over a jet of quenching oil for quick cooling.

Another arrangement for heat-treating shot was displayed by the Selas Co. The shot is lifted, point upward, into a radiant bell where it is heated in four minutes for the 75 mm. size. It can then be dropped into a quench to complete the cycle in three minutes additional.

Furnace Displays

The American Gas Furnace Co. called attention to its innovation of using cast link conveyors of heat-resistance materials for continuous fully inclosed furnaces. The National Machine Works featured its Kinetic Curtain burner which excludes air from the furnace atmosphere by means of a fire curtain outside the furnace door.

The Lindberg Engineering Co. showed its Super-Cyclone furnace in which temperatures from 250 to 1750 F. can be obtained by 100 percent cross-convection heating. It is claimed that the absence of radiant heat reduces distortion. The furnace combines a hardening, normalizing, annealing, and tempering units into one.

D. P. Smith, manager, Washing Machine Division, Alvey-Ferguson Co.

The Surface Combustion Co. emphasized the value of prepared atmospheres and particularly its new RX gas used for carburizing and heat-treating high carbon steels where a bright clean surface is desired.

Electric salt bath furnaces were exhibited by the Upton Electric Furnace Division, Commerce Pattern Foundry & Machine Company. Electrodes in corner welds are away from the work and are supplied by water-cooled buses.

Automatic heating devices are being successfully applied to the Ohio Crankshaft Company's induction hardening machines. On display at the show was the set-up for hardening grinding media for cement mills.

The Morrison Engineering Corp. exhibited a continuous gas mouth-annealing furnace for use with various sizes of cartridge cases. The feed is adjustable by means of a Reeves variable feed drive.

The Hevi-Duty Electric Co. displayed a new gas preparation unit for use with controlled atmosphere furnaces. The unit is designed for the preparation of partially combusted manufactured, mixed, natural or liquified petroleum gases.

A large size vertical recirculation furnace was shown by the Harold E. Trent Co. This furnace uses salt or oil as a medium for annealing, drawing and hardening. It is especially useful on long narrow shapes such as broaching cutters, shear blades, reamers and tubes. The new size is 18 in. in diameter by 18 ft. deep.

Another vertical furnace, shown by

D. M. Macconel, president, J. K. Sutherland, assistant sales manager and L. W. Hood, sales manager, Machinery Manufacturing Co.

George L. Bond, Jr., and R. M. Gibbs of Jones and Laughlin Steel Corporation

the Sentry Co., measures 6x6x40-in. deep. Also electrically heated, this unit is capable of reaching temperatures up to 2350 F. It uses the Sentry diamond block method of atmospheric control.

The "Temp-A-Trol" forge welder, exhibited by the Progressive Welder Company, featured refrigerated electrodes and the mounting of thermocouples in the electrodes to permit automatic operation of sequence control of welding current and pressure throughout the welding cycle. This company also exhibited a flexible spot welder for light-gage aircraft steels with the same type of "Frostrode" cooling of the electrodes and electronic timing of welding cycles.

Sciaky Brothers exhibited a number of magnetic-discharge spot welders for aluminum alloys, as well as a new radial portable a.c. spot welder designed for joining light-gage steel sheets. A number of different types of welding guns are available for this unit, including a 360-deg. head which can be positioned quickly at any angle to suit the work. Of particular interest, also, was the announcement by this company of an improved method of determining the soundness of spot welds in sheet aluminum alloys with X ray inspection apparatus. This involves painting the surface of one of the sheets with an iodine solution at the points where spot welds are to be made.

The "Positive Arc" a.c. arc welder exhibited by Welding Apparatus Co. is made in three sizes, with capacities ranging from 60 to 255 amperes. These transformer-type welders are mounted on casters to permit moving them easily in the shop.

Marquette Manufacturing Co. exhibited transformer-type arc welders mounted on wheels and equipped with truck-type handles to facilitate movement in the shop. The maximum size welder now made by this company now is of 400-amp. capacity. Automatic voltage control is featured.

A practical demonstration of the brazing of copper joints with the new "Phos-Copper" brazing alloy was given at frequent intervals in the Westinghouse Electric and Manufacturing Company's booth. This alloy melts at about 1304 F. and becomes fluid at 1382 F., yet it is chemically stable.

In addition to exhibiting parts faced with hard-facing alloys and overlay metals for resistance to wear and corrosion, the Wall-Colmonoy Corporation announced a new series of weldable alloys for tipping metal cutting tools. These alloys are applied to either soft steel or high-speed steel shanks by heating with an oxyacetylene torch, using a "soft" flame.

Portable X-ray Equipment

To meet problems arising in the production of aircraft and armament on a mass scale, manufacturers of X-ray equipment displayed new models which gave greater portability and ability to perform a wider range of functions. At the instance of a bomber plant, Kelley-Koett Mfg. Co. has evolved equipment that can be carried by hand and small enough to get inside wing assemblies. In addition to conventional X-ray pictures, this unit can be used for X-ray diffraction analysis and micro-radigraphy by merely exchanging tubes and transformer taps.

For the same purposes, General Electric X-Ray Co. offered a small portable machine featuring low-voltage operation and ability to plug in at any light socket.

In contrast, to these developments, Picker X-Ray Corp. exhibited a new 250,000-volt portable equipment akin in size and appearance to a trench-digging machine. Through improved oil cooling of the X-Ray tube, approximately 50 percent more power can be utilized, thereby speeding exposure time when checking welds or sections in large work. The mobility of this equipment is attained through a pneumatic tired mount and a self-contained cooling system that needs no water or drain connections. Picker also showed a variable-intensity illuminator by which light and dark sections of X-ray negatives can be lighted as required to permit detail inspection of any portion of the subject.

A small low-cost "Micro-Chek" comparator that can be mounted on a simple base in connection with V-blocks and other work-holding devices is available from Trico Products Corp. The maximum tolerance for "go" and "not go" is established by setting the two masters in the fixture in turn, pressing a button, and setting the respective tolerance indicators to match the position of the indicator finger. Visual checking to less than 0.0001 in. is possible with the "Micro-Chek," although the comparator costs but a few dollars.

Refrigerating Units

For welding-tip refrigeration, aging steel to prevent growth, aircraft rivet storage, testing instrument functions over wide fluctuations in temperature and making expansion fits, Kold-Hold Mfg. Co. displayed a line of industrial "sub-zero" machines. One of these units was adapted to utilize a liquid bath—petroleum spirits or alcohol—for more rapid removal of heat from gage blanks and similar items when artificially aging, or stabilizing, steel, by repeated cycles of cooling to —60 F, and re-exposure to room temperature. An aircraft rivet-storage cabinet was fitted with tubular chambers for storing various sizes and types of rivets in the same equipment. Production men responsible for mass output of aircraft instruments displayed interest in a cabinet for mounting the devices and checking their action under a wide temperature range, from —60 F. to +120 F. in hourly cycles.

For the supply of coolant in large quantity at machine tools, or to act as a standby unit in case of breakdown of the machine's coolant system, Gray-Mills Co. introduced a "big sized" portable coolant pump capable of handling up to 1000 gal. per min.

Philip M. McKenna, president, McKenna Metals Company

INSIDE DETROIT

BY RUPERT LE GRAND

Tooling Advisory Service to expand; will issue bulletins advising from whom and when gage deliveries are available. Auto men urge return to their Detroit pre-war materials scheduling practice.

Tool Service to Be Expanded

To balance the supply of gages with demand, the Tooling Advisory Service of the Automotive Council for War production will be expanded to a national undertaking, according to plans now in the making. The program has the enthusiastic endorsement of General Campbell, chief of Ordnance, and of Generals Glancy and Armstrong of the Combat-Automotive Center.

Each week the Tooling Advisory Service, 514 Boulevard Bldg., Detroit, mails a pamphlet "Available Tooling Facilities" to 1500 tool buyers. The Oct. 19 issue lists 115 tool shops in the Detroit area (and a few in other states) according to delivery time promised on jigs and fixtures, gages, cutting tools, sheet-metal dies and forging dies. The precision rating of each shop is also indicated.

Will List Shop Facilities

One of the main proposals in the plan now taking shape is to list each week the same kind of information for all of the tool shops in the country which can make plug, ring, snap, thread, spline and other forms of gages, as well as gaging fixtures. Probably, a national listing will comprise between 200 and 300 names, because at least 50 percent of gage and tool capacity, outside of the major gage-production shops like Brown & Sharpe, Pratt & Whitney, and Sheffield, is concentrated in the Detroit area. Moreover, the mailing of Available Tooling Facilities will be expanded to perhaps 5,000 tool and gage buyers throughout the country.

The purpose of the expanded effort is of course to bring together quickly the shop able to make a gage or tool with reasonably quick delivery and the purchaser, either in industry or in Ordnance, Navy or Air Corps procurement offices. Often a tool or gage that is classified as a standard can not be delivered in less than a year by one of the big gage or tool companies, but when treated as a special and given to a small plant or jobbing shop, it is possible to get fast delivery. For example, 32 out of the 115 job shops listed for the Detroit area by the Tooling Advisory Service are currently able to make delivery upon plug gages in three to six weeks. In fact the delivery situation in several gage categories has improved markedly in recent months.

Gage Demand to Increase

Nevertheless, gage procurement is one of the most serious problems in all manufacturing areas, and the demand for gages will increase with expanded armament production and design changes. To overcome the delays incident to customer-buying habits, lack of knowledge concerning all sources, and the tendency of even distant subcontractors to rely upon Detroit for gages, top ranking officers are enthusiastic concerning the possibilities of the industry cooperation through the expanded AWCP plan. Details of the entire plan are to be presented to all gage-section chiefs of Ordnance, Navy, and Air Force procurement districts.

Ordnance personnel are hoping that the expanded activities of the Tooling Advisory Service will go far toward balancing gage supply with demand by making full use of existing facilities on a national scale. They argue that merely giving shops additional machinery is not the best way of handling the situation. Future releases of machine tools to tool and gage plants may depend upon demonstrated need after the current proposal has been tried.

HUDSON TO BUILD "INVADERS"

DETROIT—A powerful marine engine, known as the "Invader," and much larger than an automobile engine, is to be built by Hudson Motor Car Co. to power invasion barges for the Navy.

Although the difference in size and design of the marine engine poses manufacturing problems, the Detroit firm will produce the power plant almost entirely with converted automobile machinery. Parts manufacture is already underway. The new contract is the third major war-production project which Hudson has revealed in recent weeks.

Clearing House Is Suggested

Other features of the plan are still being mulled over. One suggested by the Automotive Council for War Production is that each tool user appoint a man to act as a clearing house of information relative to tool needs and tools on hand. A central information clearing house may also be established. Too often one plant has great difficulty in getting say a half dozen drills of a certain size, and a concern in the next community has an over supply.

In the search to find gages to meet pressing Ordnance needs, it was originally suggested that idle inspection devices left over from automobile production might be reworked. The merits of an expanded salvaging activity in respect to gages will be given serious study by AWCP.

Automotive observers understand that they did not win complete acceptance by WPB for the industry-sponsored materials scheduling plan, and that instead some features of both this plan and the steel budget plan will be combined into a new program to replace the obsolete Production Requirements Plan, or PRP. Close control of critical materials will remain, but with some flexibility and a minimum of paper work.

Wish to Avoid Red Tape

What the automotive industry wanted in the new materials control plan is avoidance of red tape and poor planning that either fails to get the material into the plant at the required time, or in the required quantities. PRP failed dismally here, for many plants did not receive fourth-quarter allocations until well into the final 90-day period, and in many cases cut-backs on materials gave them unbalanced supplies of commodities. It is not much help to get 50 percent of copper, and 90 percent of alloy steel, for production is pulled down to the level of the lowest percentage, and inventories are built up for materials in the higher percentages.

Central Plan Is Like Peacetime

A committee of top ranking automobile men visited Washington to explain the advantages of the materials-control plan, which in many aspects follows customary Detroit practice in peacetime. Vital features of the materials scheduling plan as it is called were: (1) bills of materials be submitted to Washington, (2) requirements of all bills of materials to be totalled, (3) comparison made with the charts of materials available, (4) Army and Navy to fit orders to materials available. The holder of an order would then have the right to place materials orders with vendors, later reporting

his purchases to WPB for auditing and checking. Thus, Washington's paper work, the bottleneck to date, would not interfere with actually putting the goods into production.

The Iron and Steel Branch of WPB, and Ferdinand Eberstadt, a deputy chairman of WPB (and formerly an investment banker) favored the steel budget plan which required the manufacturer to work out the materials required for an order and then justify them at Washington, before getting a certificate. That, said Detroit, is just so much more red tape. If allowed to proceed on the usual lines or setting up materials bogies on a 90 day basis, and then releasing them on a 30-day schedule as in the automotive production days, actual arms output could be cut back at any time by dropping a few days production. There still seems to be some question at Washington, in regard to the trustworthiness of industrial leaders. To argue that Detroit will grab all available materials, because it knew where to bring pressure in pre-Pearl Harbor days, is to take a dangerous line. For as one automotive spokesman said, the issue of materials control is next in importance to military strategy toward winning the war.

WPB Shows How It's Done

WASHINGTON—Object lessons in the substitution of non-essential materials are presented by an exhibit prepared by WPB. Shown are a large number of substitutions of glass, cast and machined steel for bronze, brass and copper, and displays of many uses of plastics. Included is sponge glass, which is impregnated with gas and weighs as much as balsa wood, and floats. Also shown is a glass sleeve, which fits over the machined stubb of a propeller blade while the blade is being sandblasted; glass sleeves outlast steel sleeves many times over.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ALUMINUM SCRAP—If borings, turnings and similar machinings contain oil, water or other forms of contamination, maximum prices may be paid only on basis of actual weight of aluminum or aluminum alloy contained. (Amend. 1, Revised Price Schedule 2.)

AUTOMOTIVE REPLACEMENT PARTS—Application of PRP has rendered ineffective Amendment 1 extending terms of order until Dec. 13, 1942, and it has therefore been revoked. (P-107, Revocation.)

CONVEYING MACHINERY & POWER TRANSMISSION EQUIPMENT—Extension of 30 days for filing production schedules has been granted, effective Oct. 7. (Amendment 1, Limitation Order L-193.)

EXPORTS — All exports, including Lend-Lease shipments and unrated orders, as well as those assigned preference ratings by Board of Economic Warfare, have been freed from end-use and inventory restrictions in foreign countries. (Priorities Regulation 15.)

HACKSAW BLADES—Sale of low-alloy steel blades used in ordinary hand frames is permitted. (Amendment 1, Preference Order E-7.)

HAND SERVICE TOOLS—Sales and deliveries by manufacturers have been limited to purchase orders rated A-9 or higher. At the same time further limitations have been placed on types of alloy steel from which these tools may be manufactured. (Amendment 2, Preference Order E-6.)

LIGHTING FIXTURES—Manufacture or sale of blackout and dimout fixtures which do not conform to specifications of War, Navy Departments and Maritime Commission has been prohibited. (Order L-168.)

MECHANICAL PENCILS—A clarifying amendment changes the order to read "Pencils, mechanical or automatic." (Conservation Order M-126.)

NICKEL—Use of this metal has been restricted to implements of war and other products certified by Army-Navy Munitions Board, except where specifically authorized by director general for operations. (Amendment to Conservation Order M-6-b.)

STEEL CASTINGS, MANGANESE—New maximum price regulation establishing ceiling prices to levels prevailing between Oct. 1 and 15, 1941, applies not only to producers but to all persons dealing in this material. (Maximum Price Regulation 235.)

STEEL SCRAP, ALLOY—Segregation of low-phosphorus and low-sulphur stainless steel turnings has become mandatory in order to prevent indiscriminate melting. (Amendment 1, Supplementary Order M-24-c.)

THERMOPLASTICS—Effective date of scheduling provision previously postponed to Oct. 1 has been again postponed to Nov. 1. (Amendment 3, Preference Order M-154.)

Liberty Ship Building Time Steadily Shortened

WASHINGTON—Liberty shipbuilding time continues downward to the amazement of all observers and the consternation of the Axis. Admiral Emory S. Land, chairman of the Maritime Commission, promises that all transport operations will be returned to private ownership when peace comes. Meanwhile, the Commission and the industry are both wondering what should be done with the Liberty ships when ocean commerce is reestablished. And all surface shipping men, eyeing the volumes of cargo being flown by the Air Force Transport Command, fear that airlines operating heavy equipment all over the world, will seriously cut into their traffic.

Both the Italian and the German governments give the lie to reports of speed on our ship construction—to their citizens. But they well know the truth, and they are deeply disturbed, as well they might be. For in September, Liberty ship time went down from 8.3 days in August to 70.1, average in the ten yards participating.

Kaiser Yard Again Leads

The Kaiser yard, Oregon Shipbuilding Corp., at Portland, is again leading at 42.0 days average for 11 ships in September. Kaiser still holds the single ship record, too: 13 days 23½ hours. Second to Kaiser's average is the McCone-Bechtel California Shipbuilding Corp., at Wilmington with a record of 55.9 days in September for 12 ships. Kaiser's other two yards are fourth and sixth in the running.

Number 10, slowest of all, is the Todd-Bath South Portland Shipbuilding Corp., South Portland, Maine, with an average of 198.0 days for one ship in September.

But even the slowest is excellent, by comparison with the average time of 241.3 days last January. It is a fact, little-noticed, that the Maritime Commission originally estimated the Liberty ship could be built in 105 days, and the builders said it was not possible.

Admiral Land's promise to give shipping back to its original owners come peace is no surprise, of course. A matter of real concern is what to do with the Liberty ships, which will constitute one-fifth of the world's tonnage if the war ends in a reasonable time. The chairman says these ships can be (1) sold to foreign countries, (2) sold to speculators, or (3) be held in reserve for emergency by the government.

Apparently there is no thought that these ships can stay on the seas in competition with faster vessels which this country and others will build. Thus, except for our relatively small number of "C" ships, we will still face the need for a new merchant fleet if we are to resume our rightful place in world ocean traffic.

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

Contract renegotiation, based on decreased costs of mass production, is bringing considerable returns. OWI's report on American airplane performance is fair, unbiased, pulls no punches. Air needs recognized

Renegotiations Bring Returns Renegotiation of contracts is bringing three or four hundred million dollars into the Navy, including one item of $40,000,000, but not without trouble. The contractor objects, because he has to face the uncertainty of future taxes, he has to face Mr. Henderson's OPA, and, not least, he must try to anticipate future renegotiation.

James V. Forrestal, undersecretary of the Navy, made some newsy observations on renegotiation as he testified in Congress on the second war supplement appropriation of 1943.

He said that the Navy is having its chief trouble with the little manufacturers. The big companies are too conscious of their own public relations to try to make a lot of money. But the little ones, most of whom came into the business with small capital, are not so cagey.

Navy Primarily Wants Results It appears that even the mighty men of the Navy have kind hearts and they hate to touch a company for a refund when it is doing a swell job. Mr. Forrestal used Grumman Aircraft as an illustration. He said that Grumman, a little plant run by two men, had grown from a volume of $6,000,000 a year to book orders totaling three or four hundred millions. This plant is not only building first-rate airplanes, but its management, Mr. Forrestal observed, has a headache in the form of a vast inventory to be controlled.

So the Navy said to one of the Grumman bosses, ". . . if this renegotiation is a particular headache to you and is stopping you from getting out aircraft, we will deal with you fairly, but for God's sake go to work and make planes. I would rather be jailed two years hence than to have you stop making planes." This reveals not only a human streak in the Navy, but also the fact that Mr. Forrestal thinks the war might end in two years.

Plane Manhours Cost Reduced The undersecretary further stated that the total cost of the big airplanes in terms of manhours was something like 700,000. This would mean planes like the B-17 and the B-24. It has gone down to 400,000 for the B-24. That means the labor component of airplanes on real production lines has declined to about half what it was, and is still going down.

Forrestal said that reduction in costs is largely due to mass production improvements, and implied that not much is due to error. As the producer gets better organized he increases his volume while his overhead lags. The undersecretary said the Navy is taking every precaution to see that contractors do not make more than a fair profit.

OWI Air Power Report is Good Office of War Information's report on American airplane performance comes as a sort of anti-climax, the controversy having all but petered out when the House Military Affairs Committee took expert testimony and told the country to stop fussing.

But OWI's evaluation is none the less well worth reading in full by every person interested in military aviation. It is a scholarly job, done from the ideal journalistic viewpoint, which sees both sides of a contention. For that alone it is remarkable, coming as it does from a propaganda agency intent upon whooping the war along.

APPOINTED

Edwin H. Brown has been appointed assistant chief, Iron and Steel Branch, WPB, heading the Plant Facilities Section. He is a vice president of the Allis-Chalmers Corporation

The report is full of information for aviation men and for laymen alike, who, incidentally, can understand every bit of it. For instance, it explains that our aviation in the Pacific took a beating because adequate raid warning systems had not been provided. The American Volunteer Group, in China, with the same kind of fighter planes, but with the best warning system in the world, simply knocked the kimonas off the Jap air attackers.

Air Power Need Is Recognized Navy gets 14,611 planes, in addition to its existing program, under a second supplemental 1943 war appropriation. About 68 percent of the total of $6,236,956,621 is for Naval aviation. This vast expansion is in recognition of the dominant part aviation is taking in the Pacific war. The new planes will be for 500,000 tons of carriers, appropriated for at the same time. Navy's present program is 27,500 planes by early 1944. But more planes is not the only aim in appropriation funds for new orders; another objective is to assure continuous operation in plants where gaps would appear in 1943.

New Navy program does not go beyond the President's goal of 185,000 planes in 1942-43. Fifteen thousand in 1942 and 25,000 in 1943 of that total are training planes, not definitely divided between Army and Navy. Some types are used by both. Of tactical planes, Navy gets 10,170 in 1942 and 21,790 in 1943. This makes a total of 31,960, not including trainers and transports, or the total to be achieved in early 1944 under new appropriation.

500,000 tons of aircraft carriers are included in the Navy's share of a second 1943-fiscal war supplement appropriation approved by the House. This would total 25 carriers, if you guess 25,000 tons apiece. Carriers are playing a major part in Pacific war, and they are now the capital ship of the fleet. Battleships have at no time been reported on our side of the war with the Jap. The carriers will receive most of the 14,200 Naval airplanes provided in the same appropriation bill. Some recent reports have indicated the new carriers might be small like those of the Jap navy, but hearing records reveal they will be full size. (The average is about 80 planes apiece.) Navy witnesses admitted big carriers make a good target, but said they can carry more defending guns and planes and they can take more punishment.

Manpower Control to Have Laboratory Run in Baltimore Area; Participation is Voluntary

BALTIMORE—By reason of the middle of the road nature of it's labor problems, Baltimore has been chosen as the site for a laboratory test of manpower control. The War Manpower Commission has set up its first area office there and is trying out the techniques that it will eventually introduce in other war production centers.

A city of 860,000 peace-time population, Baltimore has about 25 major plants doing war work, employing about a quarter of a million workers. Twenty percent of the population is negro, but there is little negro employment in war plants. Baltimore's war industries are diversified, covering aircraft, shipbuilding, radio manufacture, machine tools, steel-making, ordnance manufacture, and substantial contracting. The war has brought an influx of outside workers, averaging about 3,500 a month.

Participation in the Baltimore trial is voluntary, and in that respect it is not typical of what is to come. Pending legislation, there are two enforcement weapons: The Selective Service System and the contract-letting power of the Army.

The Baltimore program has two main objectives: To see that war industries get the labor they need, and to prevent them from getting it from each other or from importing it to an extent which unnecessarily increases migration into the city.

The second of these problems has been approached through semi-voluntary agreements. The 25 war plants and about 500 others were asked, by letter, to sign an agreement that they would not hire anyone now working in a war industry without the consent of the present employer. Arrangements are included to appeal any dispute to the U. S. Employment Service. The agreement also provides that no labor will be imported except through facilities of USES. All of the war plants and most of the others signed.

Baltimore union locals were asked to accede to the antipiracy plan and to sign an agreement that they would not transfer union members to Baltimore except with USES clearance.

It is planned that, industry by industry, firms will be asked to go over their personnel, in consultation with their unions, and determine the minimum number of men they require. Then they are to pick the ten most suitable for transfer and to urge them to move into war industries.

Crucial to this plan is an agreement on the part of the nonessential employer to give any transferred employee preference in rehiring after the war, and to assure him that upon return he will regain his seniority rights.

Legislation Not Far Off

The strongest pressure available against the nonessential firm is the general recognition that legislative compulsion is not far off. This has been strengthened by an agreement that any men transferred voluntarily will be credited to the firm when the time comes for compulsory transfers. It is hoped that by the end of the year about 10,000 people can be transferred into war plants.

Unemployed women constitute the largest reservoir of workers. 39,000 under 45 have no young children, about 10,000 do. Of these, it is estimated that 23,000 are willing to accept work, but it is believed that no more than 13,000 actually can be put to work by the end of the year. This would just about meet the industrial demand for women workers. But unless additional women are hired, some 20,000 men will have to be imported.

Winners Announced in the Study of Lincoln Foundation

CLEVELAND — The $13,700 grand award in the nationwide 2½-year $200,000 welding study program sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, was won jointly by Capt. C. A. Trexel, director of planning and design, and A. Amirikian, design engineer, Bureau of Yards and Docks, Navy Department, Washington, D. C.

The Study brought forth reports of welding progress prepared by executives, engineers, designers, architects, production officials and others throughout the industrial field. Reports of arc welding progress in production of war equipment, including ships, tanks, planes, guns, etc., featured prominently in the awards.

The paper prepared by Trexel and Amirikian dealt with arc welding of caissons for naval dry docks. John L. Miller, chief metallurgist, Gun-Mount Division, The Firestone Tire and Rubber Co., Akron, Ohio, received the second grand award of $11,200 for his paper on the welding of the 40 mm. Bofors anti-aircraft gun and the changing of various parts from riveted to welded design. Mr. Miller reported that the cost per welded chassis was $76.80 less than riveted construction.

H. Thomasson, welding engineer, Canadian Westinghouse Co., Hamilton, Ontario, Canada, received the third grand award of $8,700 for his paper on a new type of large mercury-arc rectifier, called ignitron, which requires extremely high vacuum.

Grand Award Winners in Welding Study

CAPT. C. A. TREXEL

A. AMIRIKIAN

JOHN L. MILLER

H. THOMASSON

LINES ON AIRCRAFT

OWI pulls no punches in analysing performance of U. S. war planes. Report decries government's peacetime "determined blindness" to air power potentialities

Making good its promise to pull no punches in reporting the performance of American airplanes, the Office of War Information, releasing its findings last week, told the country not to look for spectacular victories but only for average superiority over the enemy. The report finds plenty of fault but gives full credit to plane types that have proved their worth. OWI comes near to a true juridical viewpoint in making its evaluation, and probably will capture more public credence than other appraisers who have spouted damnation or halleluiah.

Briefly, the report says some U. S. warplanes are badly designed and ill-matched against the enemy's equipment; that the Navy went to war with quantities of obsolescent planes; in the Pacific war, Army's aviation score has been much better than the enemy's, but it could have been better, with a proper raid warning system; the country paid in blood and defeat for the "determined blindness" (to the potentialities of air power) in its peaceful years; our heavy and medium bombers are superior to anything in the world.

It was the supercharger on which our liquid-cooled engine project hinged. When the first modern Allison engine was being manufactured for airplanes, its makers were thinking in terms of turbo-superchargers, which promised very high altitude. In the larger airplanes it met all expectations, the report says, but in the smaller fighters—Curtiss P-40s and Bell P-39s, its incorporation proved impossible. Meanwhile, less work on Allison's own gear-driven charger was done than if they had known it would have to be used, and precious time was lost. Now, however, a two-speed gear-driven charger has been developed and thoroughly tested, and shortly will be in quantity production.

Allison engine is vastly better than many of its critics have made out. Its horsepower has been stepped up close to 40% since the Japanese attack last year, and the British Rolls Royce, which has improved at a parallel rate, now tops Allison by only about 100 horsepower, the statement says. Few if any other liquid-cooled engines are as rugged and as responsive to field maintenance as Allison. Other makes of liquid-cooled engines are in course of development and some of them are promising. In time our lost ground will have been made up. We are not unique in our procrastination. While we developed air-cooled engines, Germany and Britain neglected them.

At medium and low altitudes, the P-40s and P-39s are shooting up the enemy wherever they meet, because of their long range, their heavy armor, and their fire power. It is necessary to climb high only to catch high-level fighters and bombers; a great deal of air combat is lower down. In fact, possession of superior high-flying fighters would by no means guarantee victory in air war. OWI's report, however, holds out hope that our Army P-47 Thunderbolt and Navy F4U Corsair, both unexcelled in altitude, will prove effective in combat. These planes both are powered with air-cooled engines of 2000 h.p. The Lockheed two-engined interceptor, P-38, extensively criticised in private, is rated by OWI as one of the best high-altitude long-range fighters in the world. Allison engines power this ship, which is big enough to permit the use of turbo-superchargers rather than the geared charger.

Steady progress is being made on standardization of accessories on U. S. and British planes of American make. The British are still using their own radio, but they use fewer and fewer parts and accessories that differ from ours. In some cases, the special things they want are shipped here for installation, and in others, the British put them on in their own shops. Pratt & Whitney engines are installed on some British planes. We are using the latest British Rolls Royce liquid-cooled engine in our P-40 Warhawk. Testimony in Congress indicates some of our small planes are being flown across the Atlantic. This is quite possible, as some of our fighter ranges are as long as 3,000 miles.

The 70-ton Mars, patrol bomber built by Glenn Martin for the Navy is being finished as a transport plane. Its cargo capacity is given as 20 tons. Navy says that no more of this type have been ordered. Construction of this behemoth revealed what happens when all dimensions of a given airplane design (presumably Martins two-engined flying boat, PBM-1) are expanded. No hint is given whether the outcome is satisfactory or not. Vice Admiral John Tower said mass building of Mars would require prohibitive expansion of facilities.

"E" Result—Employees attending an "E" award ceremony at plant of The Bullard Co. were inspired by Army planes overhead, decided to buy one as gift for fighting forces, raised $75,000 in two days. H. L. Williams, employees' plane committee chairman, made the presentation to Maj. Gen. J. E. Chaney. Sponsors were employees, Mrs. Elsie McKee, nurse, and Mrs. Esther Norell, crane operator. The latter's twin sons attended them. A flask of oxygen was used to christen the plane.

Engineers Discuss War Production Problems; Told Canada Will Control All Manpower

ROCHESTER—Problems of war production, salvage and manpower, particularly the employment of women in industry, engaged the attention of 500 engineers at the 1942 fall meeting of the American Society of Mechanical Engineers, October 12 to 14. The feature of the meeting was an address by the Honorable Humphrey Mitchell, Minister of Labour, Ottawa, Canada.

Mr. Mitchell described the Canadian war effort and reported that on December 1 the Ministry of Labour will assume complete control of man and women power. At the present time no one in Canada can take a non-essential job without a permit. He announced that such steps were necessary in order to offset the increasing number of men being absorbed by Canada's armed forces, which today includes an army of 250,000 men, a home-defense unit of 120,000, a navy of 41,000 men and 500 ships, and an air force of 125,000. Today 150,000 women are working in war plants, and this number will be doubled within the next six months.

Canada's attempts to peg prices and stabilize wages in order to avoid inflation were described by Mr. Mitchell. The effectiveness of the program is shown by the rise in the cost-of-living index from 100 in 1939 to 116.5 in September this year. This compares with an increase from 100 to 135 for the period 1914-1917.

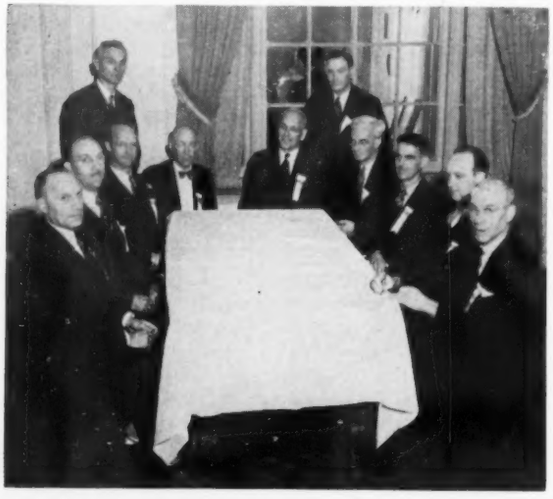
Canada's Machine Tool Output

Of special interest were Mr. Mitchell's remarks regarding Canada's machine tool industry. He stated: "The long accumulated experience in machine tool design and operation more than anything else is responsible for the record outputs of today. . . . In 1939 the output of the machine tool industry in Canada was valued at $500,000, in 1941 at $28,000,000, and for 1942 at $40,000,000. Canada has become practically independent in this field."

One of the most timely discussions at this A.S.M.E. meeting concerned the use of women in industry, especially as engineers. Dr. Harvey N. Davis, president of Stevens Institute of Technology, discussed the effect of lowering the draft age to 18 years, which by 1944 will reduce materially the number of available engineering graduates. This condition, he stated, implies the need to train women for engineering jobs, preferably college graduates with a background of mathematics and physics. Reports of other educators revealed that few women today apply for training in engineering subjects.

The substitution of wood for many of the 1,000 metal items now banned from manufacture by the War Production Board was discussed by Prof. Nelson C. Brown, State College of Forestry, Syracuse University. He referred to the use in Europe of wood gas as fuel for automobiles, trucks and busses, called attention to its use in the manufacture of explosives, clothing and even food, and told how compressed plywood was displacing metals in some instances.

The Production Engineering Division of the Society held three technical sessions at the meeting. The method of determining the load-carrying capacity of bevel gears in aircraft engines was discussed by Allan H. Candee, mechanical engineer, Gleason Works. A paper by Otto J. V. Dunhofer, aeronautical engineer, Brazilian Air Ministry, gave a theoretical analysis of constant-speed counter-rotating airplane propellers. Methods of transferring data from engineering drawings to sheet metal by photographic processes were described by E. C. Jewett and C. D. Tate, Eastman Kodak Company. John H. Maude, chief designer, Dominion Engineering Company, Ltd., Montreal, Canada, discussed the design and operation of hydraulic presses for drawing shell cases and for forging shells. Of particular interest was the description of a special indicator designed to disclose pressures in the hydraulic circuit during every phase of the drawing and forging operations.



Committee in charge of A.S.M.E. meeting: Seated left to right—Arthur W. Schuster, Cleland C. Ross, I. G. McChesney, A. H. Candee, Gleason Works, V. M. Palmer and R. F. Hooker, Eastman Kodak Co., W. D. Wood, Taylor Instrument Co., A. E. Schell, Stromberg-Carlson Mfg. Co., and S. C. Stacy, Rochester Board of Education. Standing (l. to r.) — Harding and O. L. Angevine.

At A.S.M.E. Luncheon—left to right—A. E. Schell, Stromberg-Carlson Mfg. Co.; James W. Parker, president of A.S.M.E.; Col. James L. Walsh, Chairman of A.S.M.E. War Production Committee; Honorable Humphrey Mitchell, Canadian Minister of Labour; Harvey N. Davis, Stevens Institute of Technology; Virgil M. Palmer, Eastman Kodak Co.; and C. B. Peck, Simmons-Boardman Publishing Company.

Radiography Section Formed

NEW YORK—Recently there was formed the Metropolitan New York Section of The American Industrial Radium and X-ray Society, Inc. Officers of the Section are Alexander Gobus, chairman, R. T. Purcell, vice chairman, and Jay Bland, secretary-treasurer. On the executive committee are Noah A. Kahn, Herbert Brychta, Walter Kahn and R. A. Frank. Next meeting is October 26, 8:00 p.m., at the show room of the G.E. X-ray Co.

Chester Lang Warns Gear Manufacturers Against Danger of Wartime Complacency

SKYTOP, PA.—Complacency is our worst enemy, according to Chester H. Lang, vice-president, General Electric Co., guest speaker at the 25th semi-annual meeting of the American Gear Manufacturers Association, held at Skytop, Pa., Oct. 15-17. In a stirring address, Mr. Lang deplored the fact that we spend so much time patting ourselves on the back, handing out awards and glorifying the American workmen, when the real job of fighting is being done by the soldiers at the front who has not had nearly enough backing by industry.

Howard Dunbar, vice-president and general manager of the Machinery Division, Norton Co., spoke before another session of the Association, and traced the course of war production. He told of the crystallization of thinking about war needs from the initial policy of "make all that you can today" to a planned program that directs manpower and materials into certain well-defined channels.

Among the outstanding technical papers presented before the Association was "Design and Manufacture of Aircraft Engine Gearing," by P. W. Brown, and E. B. Farrar, Wright Aeronautical Corporation. As read by Mr. Farrar, the paper discussed the various methods of producing aircraft gears and told of those found most effective in the Wright paths. A spirited discussion added greatly to the value of the session.

The important subject of materials was ably handled by E. J. Wellauer, the Falk Corporation, who told how modifications in steel compositions could be adapted to gears and other machine elements under wartime conditions. Mr. Wellauer emphasized the fact that it is essential for the designer and shop man to adjust their practices to the materials that are available. In most cases their choice will be limited, but this does not necessarily mean that the quality of their products will suffer.

During the three-day meeting the AGMA made excellent progress in the formulation of technical gear standards under the guidance of S. L. Crawshaw, Westinghouse Electric & Mfg. Co., chairman of the general standards committee. Among the new recommended practices adopted by the Association were Parts 2 and 3 of the Standard on inspection and tolerances for gears, and Section 2 on the standard for backlash.

The general sessions of the Association were conducted by AGMA president John H. Flagg, Watson Flagg Co. aided by R. C. Ball, president, Philadelphia Gear Works, and W. L. Schneider, the Falk Corporation. The excellent program was due to the efforts of J. S. Watson, the Link Belt Co., general chairman of the program committee, and to Newbold C. Coin, recently elected A.G.M.A. secretary.

A.G.M.A. President J. H. Flagg (r.) and W. L. Schneider, commercial committee chairman, conducted the three-day business and technical sessions

Chester H. Lang, guest speaker talks things over with Newbold C. Goin, A.G.M.A. secretary

A.G.M.A. Vice President R. C. Ball greets Howard Dunbar who addressed a session on war production

Firmness and Scorn Reduce Lateness and Absenteeism

NEW YORK—The hard-boiled tactics of one company toward late and absent employees have reduced absenteeism and tardiness to two percent, with the chance of going lower.

Late-comers find the gates closed to them, and unsympathetic guards direct them to the personnel office, where, after waiting their turn, an unsympathetic personnel man listens to their excuses. If they can convince him, they are passed in. Repeaters that week get a day off without pay. A double repeater is probably discharged.

On the first day of an unexplained and unauthorized absence, a telegram is sent to the worker's home reading: "War production workers should be on their jobs. Explain reason for absence." No one likes to receive telegrams. Usually they mean bad news, hence they are more effective than telephone calls or personal visits, and the whole family sits up and takes notice.

On the second day of unexplained absence, the absentee's employment is suspended. His time card is removed from the rack, sent to the personnel director, and replaced by a bright red card reading "AWOL—Report to the Personnel Department." He is not permitted to start work until he has satisfied the personnel director that his reason for absence and failure to notify were good ones. In the meanwhile he is spotted for all to see, by the shirker's card in the time rack. Most workers don't like to have that happen more than once.

The foreman's cooperation and support of this program are obtained in two ways. An unusual number of AWOL cards in his department's time-card rack speak poorly for the efficiency of his division, so he does his best to hold them to a minimum. The first question he is asked on the regular Monday departmental inspections, made by the works manager and the production manager, is: "How does your attendance sheet look?" Obviously the foreman will support anything that tends to make it look better.

Tool Engineers Discuss Conservation and Materials Substitution at War Conference

SPRINGFIELD, MASS.—With a registration of more than 830, and with standees at nearly all of the technical sessions, the American Society of Tool Engineers tackled war production problems at their semi-annual meeting held at the Hotel Kimball here on Oct. 16 and 17.

In approaching the subject of tool conservation, Dr. A. B. Kinzel, senior consultant, Ferrous Metals Section, Conservation and Substitutions Branch, WPB said, we must first consider the problem of getting a given tool to cut the maximum number of parts. Next we must consider alloy efficiency, and finally inventory efficiency.

"A terrific saving in high speed steel can be made by using tipped tools instead of shank tools," Dr. Kinzel said. The methods of making high speed steel tipped tools are similar to those for carbide-tipped tools.

Larry W. Lang, manager, National Tool Salvage Co., emphasized the increased importance today of salvaging worn tools and said that the man who has charge of crib stocks is the man to decide when tools should be reconditioned. Arthur A. Merry, production engineer, Pratt & Whitney Aircraft, stated that the average shop has sidestepped cutting tool responsibility. He described a method for removing broken taps or drills and thus salvaging the work. A welding rod is welded to the broken end and it can then be extracted.

I. A. Hunt, manager, Federal Products Corp., spoke on subcontracting of heterogeneous parts

Col. H. B. Hambleton, office of the Chief of Ordnance, suggested the possibility of using glass for certain types of gages. The Ordnance Department is developing such gages, he said. The gages can be made by present gage manufacturers on existing equipment. They can be used for accuracy comparable to that which can be controlled with ordinary plug gages, and are not easily broken, Col. Hambleton reported. Carlton G. Nelson, quality engineer, Colt's Patent Fire Arms Mfg. Co., reviewed and described gages used to check machine gun parts. Chairman of the session on inspection was Henry J. Richards, chief inspector, Supercharger Plant, General Electric Co. He said that the aim of mass production today is to make as many parts as possible on each set-up and to the required tolerances.

Training on the Job

Charles C. Gorham, supervisor of training, Greenfield Tap & Die Corp., told the session on training that we must teach plenty of mathematics in industry. No other subject has the power to develop clear thinking and logic as this has. Pointing the need for trained men, Thomas O. Armstrong, industrial relations manager, Westinghouse Electric & Mfg. Co., stated that of every 100 men inducted into service, 63 are required for some specialized branch. He also pointed to the conclusion of the TWI branch of WPB that 95 percent of all training in industry must be done on the job rather than in some preliminary course.

Arnold Thompson, chief tool engineer, National Steel Car Corp., in discussing training women in industry said that he felt trade school training is more detrimental than useful. The job is one of careful selection and then training on the job, Mr. Thompson said. S. J. Hoexter, senior specialist, ESMWT, Federal Security Agency, U. S. Office of Education, said that because of the shortage of time we have to produce what he called fractional craftsman who can be produced in the shortest possible time to fill an existing need.

In the session on materials substitution, L. S. Bergen, associate director of metallurgy, Crucible Steel Co. of America, gave a review of the National Emergency Steels. P. S. Carswell, director of research, and C. H. Whitlock, technical engineer, both of the Monsanto Chemical Co., discussed the use of plastics as substitutes. On display was a cutter developed by Frank Curtis of the Van Norman Machine Tool Co. which consists of flat high speed steel blades molded in a high-impact type plastic body. Only eight percent of this reamer is steel, the rest being the plastic.

Ordnance inspection gages were discussed by Col. H. B. Hambleton, office of the Chief of Ordnance

Charles C. Gorham, supervisor of training, Greenfield Tap & Die Corp., chairman of the session on training

Record of New Equipment

In one of the sessions on war tooling, Elmer A. Clark, vice president, Budd Wheel Co., described the job that Detroit has done in tooling for war production. Gordon G. Swebilius, vice president, The High Standard Mfg. Co., discussed emergency tooling of used machine tools. He said that after getting started on gun manufacture on rebuilt machines, they have replaced them with new equipment as it became available. In the last month, operating in the same space, shipments were five times as great as they had been previously.

William F. Azmus, tool engineer, Consolidated Aircraft Corp., discussed plastic jigs and fixtures. He said that in one instance on the B-17, three

Left to right, G. W. Swebilius, vice president, The High Standard Mfg. Co.; R. F. V. Stanton, manager, Subcontract Div., Pratt & Whitney Div., Niles-Bement-Pond Co., O. W. Winter, pres. A.S.P.E.; and E. A. Clark, vice pres., Budd Wheel Co.

months were saved by using plastic tools, because of the speed with which they can be made. One of the newest applications is to use a plastic punch with a Kirksite die. The plastic punch has a certain resiliency and hence tends to return to the shape of the die, whereas the lead punch previously used would not.

I. A. Hunt, manager, Federal Products Corp., discussed the subcontracting of heterogeneous work to small shops. B. R. Hoel, sales engineer, Johnson Tool and Engineering Co., described tooling of single purpose machines for the 90 mm. gun mount. E. H. Johnson, president of this firm and consultant to the conversion unit of the Army Ordnance Dept., spoke at the session on tool conservation and appealed to the tool engineers to do everything they could to help in the tool conservation program.

Chairman of the sessions on war tooling were R. F. V. Stanton, manager, subcontract division, Pratt & Whitney Div., Niles-Bement-Pond Co., and John W. Geddes, chief engineer, H. K. Porter, Inc. Chairman of the session on materials substitution was J. B. Savits, methods engineer, Pneumatic Scale Corp.

The speaker at the banquet was Thomas H. Beck, president, Crowell-Collier Publishing Co., whose subject was "The Greatest Gift Is An Open Mind." Toastmaster was Otto W. Winter, president of the society. Frank W. Curtis, was general chairman of the War Production Conference. By action of the board of directors Certificates of Appreciation were presented to those who took part in the sessions. The directors voted to hold the next fall meeting in Indianapolis.

Canadian Gold Industry Sacrificed to Base Metals

OTTAWA—Canada's large and expanding base metal production will draw much of its labor requirements from now on from the gradually contracting gold mining industry. Nickel mines and refineries are already recruiting, with government assistance, from Northern Ontario gold plants. International Nickel at Sudbury, Ontario, lost over eight hundred men on the eve of payroll deductions for income tax and forced savings and replaced them mainly from the Kirkland Lake gold field.

Contraction of Canadian gold operations was foreseen as inevitable before Washington moved to close down gold mines in the United States, but control authorities planned that it should be gradual, paced to the increasing demand for labor in war industry. The estimate of Metals Controller George Bateman was that gold output would be brought to a standstill in about two years if the war lasts that long. A deterrent to wholesale curtailment has been the importance of gold in financing Canadian war buying in the United States. Without it Canada would have faced a very critical U. S. exchange problem. As it was, the exchange shortage was only overcome by the Roosevelt-Mackenzie King agreement under which the U. S. undertook to buy a certain volume of Canadian goods for cash.

Now the Cabinet has intervened to modify somewhat the pattern for gradual contraction. Curtailment of gold operations will still be gradual but at a faster pace than had been planned. The Prime Minister himself has issued a special directive to Wartime Prices and Trade Board, which is in charge of industrial curtailment, requiring reduction in operations in the interests of direct war industry.

Unity With Washington

Although mention is not made of it officially, there is no doubt that Washington's move against gold operations in the U. S. is a factor in the hardening of the approach to curtailment here. It is felt that it wouldn't do for Canada to remain out of step with the U. S. in such a matter—that if it attempted to do so this country would be open to the charge that it was not making equal sacrifice for the common war cause. It had been expected, in fact, that Washington would intimate disapproval if Canada sought to escape a curtailment of civilian enterprise corresponding to what the U. S. was making and that it would become difficult for Canadian mining companies to obtain replacement equipment below the border.

The stepped-up contraction will hit the smaller gold producers first and hardest. Among the larger mines it will be equalized. In the call for help for the nickel industry the Kirkland Lake companies were asked to release men on a pro rata basis.

Washington Appointments

WPB, Industry Advisory Committees:

Presiding Officers: J. J. Donovan, Chassis Parts Subcommittee, Anti-Friction Bearings Subcommittee, Material Requirements Subcommittee, Automotive Replacements Parts; Franz T. Stone, Drill and Reamer, Tap and Die, Diehead, Chaser and Collapsible Tap, Milling Cutter and Form Tool, Broach, Rotary File and Burr; John Gammell, Oxy-Acetylene Apparatus Manufacturers; Frank H. Carman, Thermosetting Plastics Processors.

WPB, Miscellaneous:

Walter E. Heller, chief, Materials Program Branch; Ernest A. McMillan, deputy chairman, Shipbuilding Stabilization Committee.

BUSINESS ITEMS

American Swiss File & Tool Co. has appointed Joseph DeJure its representative for eastern Pennsylvania, southern New Jersey, Delaware, Maryland and District of Columbia. His headquarters are at 410 Commerce St., Philadelphia.

Bokum Tool Co., Detroit, has moved to larger quarters at 14775 Wildemere where it occupies a modern, streamlined building having considerably greater floor space than formerly and additional equipment.

Automatic Machinery Mfg. Corp. of Bridgeport, Conn., has been sold to National Fireworks, Inc., and George L. Sexton has resigned as president and general manager and will establish a consulting engineering service at 1026 Seventeenth St., N. W. Washington.

Reliance Electric & Engineering Co. has leased the plant at present occupied by the Stoker Div. of the Pocahontas Fuel Co., which will be operated separately as the Marine Div. for the production of electrical equipment.

Steel Heddle Mfg. Co., of Philadelphia has recently purchased the business of J. F. Johnson & Co. which has been manufacturing precision tools, ordnance gages and special machinery for the past 32 years. The equipment and most of the employees have been moved into the Steel Heddle building where the activities will be greatly enlarged under the supervision of J. F. Johnson.

March Engineering Co. has been organized at Oshkosh, Wis., for the production of ordnance parts, with Capt. H. A. Thorndike as president and in charge of plant operations.

F. C. Tanner, now Federal Products General Manager

Promoted to Vice Presidencies at Briggs, Westinghouse, Foote Bros.

F. W. HOFMANN

HARRY F. BOE

R. G. DAVIS

NAMES in the NEWS

F. W. Hofmann has been named vice president of Briggs Mfg. Co. He was assistant factory manager of all Briggs plants before the complete change-over to the war effort and has recently been in charge of aircraft manufacturing. Mr. Hofmann has been connected with the company since 1932 and previously spent 19 years with Ford Motor Co.

Harry F. Boe, manager of the district repair and manufacturing department of Westinghouse Electric & Mfg. Co., has been elected vice president. He began his career with the company in 1901 in the shops at East Pittsburgh as a winder of motor armatures.

Russell G. Davis has been appointed vice president of Foote Bros. Gear and Machine Corp. and will continue in his capacity of general manager of the industrial gear division. Other promotions include F. A. Emmons to assistant general manager and R. B. Moir as manager, sales and engineering.

Robert C. Sessions of Sessions & Sessions, consulting engineers, has been appointed chief engineer of Brown Fintube Co., Elyria, Ohio. Before entering consulting work he was for some time in charge of the engineering and experimental division of Steel & Tubes, Inc.

K. R. Van Tassel has been made manager of sales of the newly formed integral-horsepower motor section of the motor division of General Electric Co. Mr. Van Tassel joined the company as a student engineer after graduation from Massachusetts Institute of Technology in 1925, and has been manager of sales at the Lynn Works since 1940. D. A. Yates of the motor division has been placed in charge of the Lynn motor group, now a part of the new integral-horsepower motor section which includes also the Schenectady motor section and the d.c. motor and generator group.

H. L. Watson, since 1934 executive vice president and director of De Laval Steam Turbine Co., Trenton, N. J., has been appointed president of the organization.

Charles G. Maier, well known research metallurgist and for about 20 years associated with the U. S. Bureau of Mines, has been named to the supervisory staff of Battelle Memorial Institute. He will direct and correlate an enlarged program of fundamental research, and will serve as consultant and advisor on the institute's war research for the government and industry.

Whitney C. Collins has been named vice president in charge of sales policy of the Elastic Stop Nut Corp., Union, N. J. Mr. Collins was associated with the Lockheed Aircraft Co. as vice president, treasurer and general manager, and in 1932 formed the Collins-Powell Co. of Beverly Hills, representing Elastic Stop Nut Corp. as sales engineers. He has been a director of the corporation since 1940.

W. T. Cushing has been appointed Detroit branch manager of the Bay State Abrasive Products Co. He has had 25 years of sales experience in the grinding wheel business, most of which has been spent in Michigan.

Selden H. Gorham has been made manager of dealer sales of Allis-Chalmers Mfg. Co. For the past six years Mr. Gorham has been in charge of sales and production of the feed water treating department in the Detroit district office.

G. R. Brautigam has been named manager of the Badger Wire & Iron Works, Inc., Milwaukee, succeeding H. A. Dorn, retired.

Chief Engineer *Manager of Sales* *Directs Research*

R. C. SESSIONS

K. R. VAN TASSEL

C. G. MAIER

MEETINGS

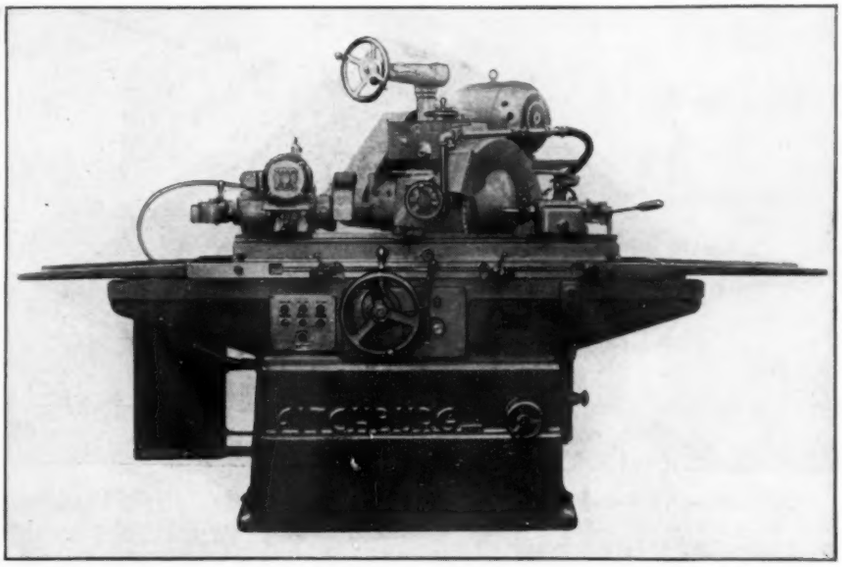
American Management Association. Two-day conference on war production problems. Hotel New Yorker, New York, N. Y. Nov. 10-11.

American Society of Mechanical Engineers. 63rd Annual meeting. Hotel Astor, New York, N. Y. Nov. 30-Dec. 4.

National Association of Manufacturers. Annual meeting. Waldorf Astoria Hotel, New York, N. Y. Dec. 2-4.

National Exposition of Power and Mechanical Engineering. Madison Square Garden. Nov. 30-Dec. 4.

SHOP EQUIPMENT NEWS



Fitchburg Adjustable Angular Head Grinding Machine Has Bowgage Wheelhead With Spring Tension Feed

Announcement has been made by Fitchburg Grinding Machine Corp., Fitchburg, Mass., of a type C adjustable angular head grinding machine, having a standard Bowgage wheelhead unit mounted so that it may be located to grind up to a 45-deg. angle. This head is adjustable and can be swiveled to various positions for standard plain grinding, and goes through a completely automatic cycle of rapid traverse to the work, correct feed, grinding dwell and rapid return. The workhead is adjustable for various lengths of work, and the work spindle can be equipped for single or variable work speeds. The truing device is mounted on the work table and is hand operated.

The wheelhead and table run on large V and flat ways. The unique spring tension method of wheel feed completely eliminates feed screws, bearings and joints. This feed method gives a vertical to horizontal ratio of approximately 250 to 1, enabling accuracy to 0.0001 in. The wheel spindle runs in special lead bronze bearings, adjustable for wear and bored to close limits, allowing the very minimum clearance for the use of low viscosity lubricants. This results in no radial spindle movement for accurate work size duplication.

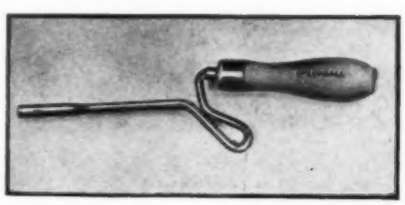
The table traverse is equipped with variable speed control. By rotating the small handwheel at the front of the machine the variable speed pulleys between the motor and the speed reducing unit swing on the pivot arm either toward or away from the motor, which increases or decreases the table speed in stepless speeds from minimum to maximum.

The machine had individual motor drives for the Bowgage wheelhead unit, table traverse, work spindle and coolant pump. Pushbutton controls for the individual motors are built into the front of the machine in a convenient operating position.

The maximum swing over the table is 8¾ in. and the maximum distance between centers is 32 in. Five work speeds are obtainable with a range of 64 to 327 r.p.m. The machine occupies a floor space of 110×68 in. and the net weight is 6,500 lb.

Aero Speedball Driving Tool Has Space for Tip Storage

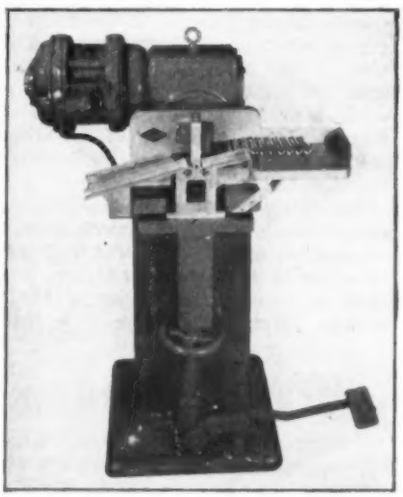
Announcement has been made by the Aero Tool Co., Burbank, Calif., of a Speedball high-speed ball bearing driving tool for driving screws, countersinks or removing burrs. Space in the recessed handle provides a convenient storage for replaceable tips, giving the tool a wide variety of uses.



The driver has a tapered shank on the tip which allows easy removal, but will not permit the tip to turn in the tool. The Speedball can be supplied in several shapes for special work. slotted-head screws, setscrews or for burring and countersinking jobs.

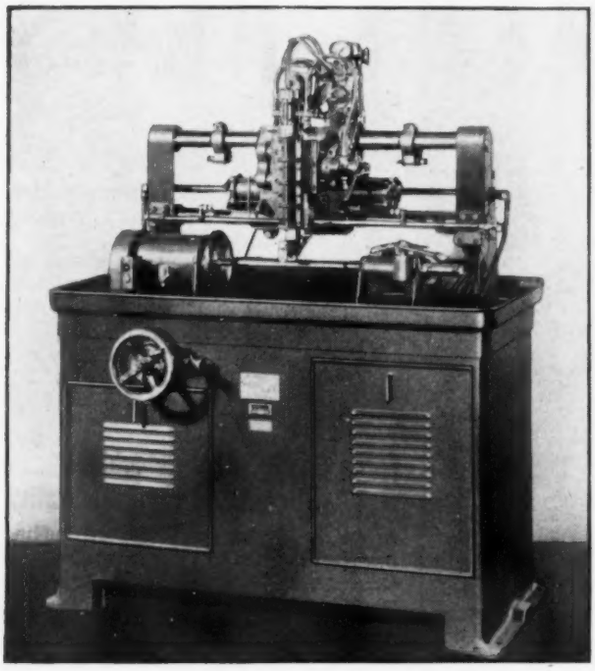
Force Shell Knurling Machine Has Simplicity of Operation

A semi-automatic knurling machine has been announced by Wm. A. Force & Co., Inc., 216 Nichols Ave., Brooklyn, N. Y. The equipment is tooled for knurling 20-mm. shells. Similar units also can be handled ranging in diameter from ¼ to 3 in. Work pieces are fed by hand to the machine. The action of the foot treadle brings the work to the knurling roll and then ejects upon retraction. A feature of the machine is its simplicity of operation.



Foster Announces Improved, New and Longer Superfinishers

Improvements have been announced in the 4×18 in. general purpose superfinishing machine, and a new and longer 4×36 in. model has been added to the line of machines offered by the Foster Division of International Machine Tool Corp., Elkhart, Ind. The machines are capable of developing a fine finish of 2–5 micro-inches on cylindrical work where surface scratches and defects must be eliminated. They are arranged with a manually controlled



variable speed drive providing spindle speeds ranging from 25 to 690 r.p.m. to the spindle and oscillating head. This head is also provided with a longitudinal hydraulic traverse, the speed of which may be varied from 0 to 30 in. per min. through the use of a traverse rate control valve. Three- or four-jaw or collet chucks may be used.

The spindle nose is provided with a No. 5 Morse taper, and work holding centers having a No. 3 Morse taper are mounted in a sleeve or adapter. The nose is arranged with large, heavy threads permitting the use of a faceplate, three- or four-jawed chuck, or special work holding fixtures.

The oscillating head is arranged with an off-center drive which provides an oscillating longitudinal traverse of about 3/16 in. This head drive is arranged with V-belt drive complete with a self-adjusting sheave wheel, which allows an unlimited number of speed changes ranging from 306 to 638 r.p.m., and correspondingly unlimited variation to the rate of oscillation of the superfinishing head. Parts without centers can be accommodated by the use of a centerless roll drive.

Kent-Owens Five-Spindle Head Mills Shell Staking Notches

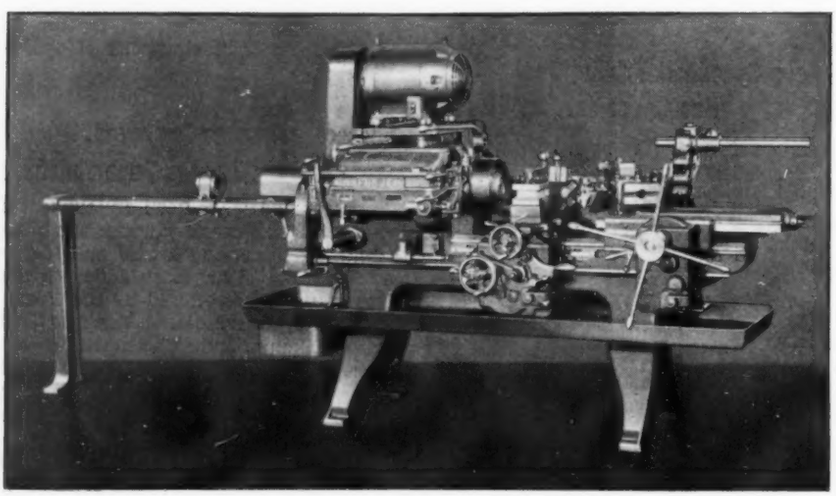
A multiple spindle head which mills all five staking notches in a shell nose at the same time has been announced by Kent-Owens Machine Co., Toledo, Ohio. The fixture is designed so that the shells are rolled onto it from an adjoining conveyor, completely notched and then rolled back onto the conveyor.

This spindle head can be adapted for use on the Kent-Owens No. 1-8 machine with hydraulic feed to the table, or the No. 1-M with hand feed.

Foster Builds Universal Ram-Type Turret Lathe with a 2-In. Diameter Collet Chuck Capacity

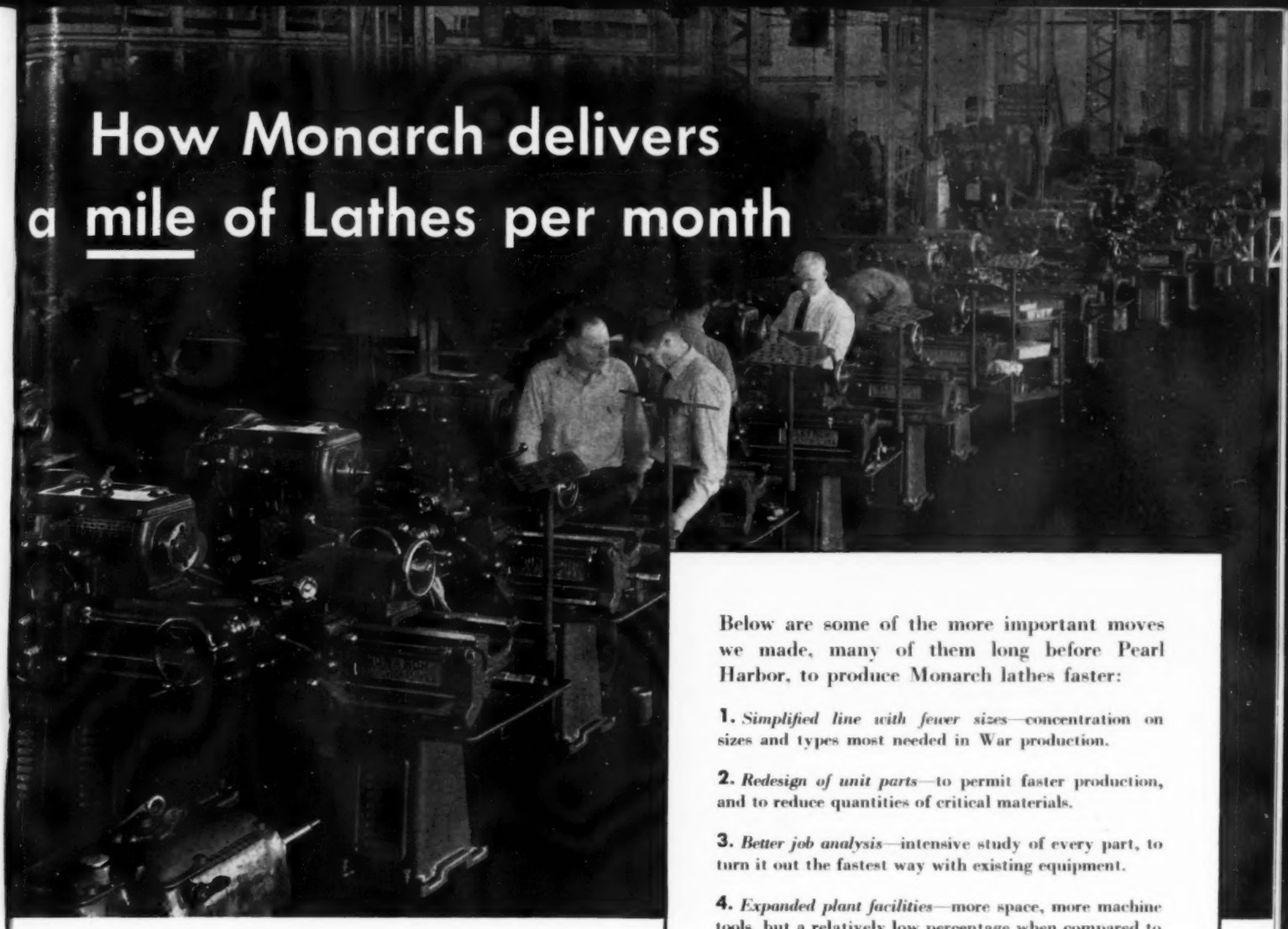
An International Foster No. 5 universal ram-type turret lathe has been announced by International Machine Tool Corp., Foster Div., Elkhart, Ind., with collet chuck capacity 2 in. dia., and having 17½ swing over ways. The lathe is supplied with tools for both bar and chucking work, and will accommodate 8, 10 and 12 in. dia. chucks.

The machine is equipped with double V-ways and the heavy bed has internal cross ribs which provide reinforcement for rigidly supporting the carriages and permitting accurate, heavy cuts. The entire bed and headstock castings are ribbed throughout to give extreme rigidity and insure freedom from vibration. The all-geared headstock provides eight spindle speeds. Individual motor drive is provided for this machine and motors of 3, 5 and 7½ hp. are furnished. Motor controls and wiring are built into the machine.



The universal carriage is provided with six reversible cross and longitudinal feeds which operate independent of the hexagon turret carriage. Feeds are engaged by individual levers which operate large diameter friction-type clutches, adjustable from the outside of the apron. A six-screw stop roll is provided for longitudinal travel of the carriage and adjustable feed trip dogs are provided for the cross-slide. This slide holds the quick indexing square turret at the front, and the rear of the slide is drilled and tapped for holding rear toolholders and forming toolholders. The quick indexing square tool post requires only a light pressure on the single lever to unclamp, index and

How Monarch delivers a mile of Lathes per month



The exact number is a military secret. But if you use the old method of placing them "end to end," they'll stretch out a mile, almost any month. And they're all going into the fight for Victory.

Our production in 1942 is double that of 1941, four times that of 1940. Several reasons account for this, which are listed briefly at the right.

If you can use our experience to increase your production, we are anxious to share it. We have no secrets about *anything* that will help bring Victory faster.

MONARCH LATHES

COVER THE TURNING FIELD

Below are some of the more important moves we made, many of them long before Pearl Harbor, to produce Monarch lathes faster:

1. *Simplified line with fewer sizes*—concentration on sizes and types most needed in War production.

2. *Redesign of unit parts*—to permit faster production, and to reduce quantities of critical materials.

3. *Better job analysis*—intensive study of every part, to turn it out the fastest way with existing equipment.

4. *Expanded plant facilities*—more space, more machine tools, but a relatively low percentage when compared to our rate of production increase.

5. *Better tooling*—to fit the job, and with almost 100% use of tungsten carbide tools.

6. *Better plant layout*—to avoid back tracking, useless handling of materials and processed parts.

7. *Reduced "waiting time"* for materials by careful scheduling, which also reduces inventories on critical materials.

8. *Supervisor training*—continuous classes to develop competent supervisors needed to guide heavy influx of new workers.

9. *Vestibule school*—for every new man and woman employed, in which they are observed, trained and then placed where they will be most useful.

10. *Three balanced shifts*—with 7-day operation to get the most production out of every machine in our plant.

11. *Loyalty and patriotism* of every employe, who knows the lathes they build turn out implements and munitions for Victory. They know this is *their* fight, too, and *they're doing the job.*

Realizing the value of *time*, we have sacrificed everything to it, except one basic principle. There shall be no let-down in the quality and accuracy of Monarch lathes, for this means only ultimate *waste* instead of *saving.*

THE MONARCH MACHINE TOOL COMPANY • • • SIDNEY • OHIO

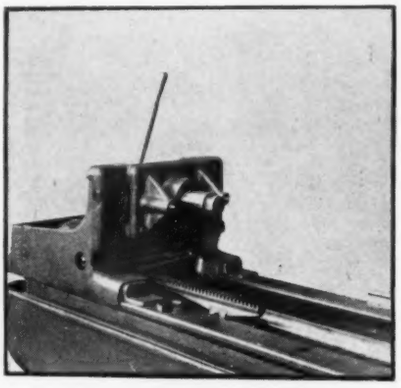
reclamp the turret in a newly indexed position.

Lubrication is automatically applied to the lathe in many places. The main spindle bearings are lubricated from oil drip cups, giving a steady flow at all times. A slight oil gage mounted in the front of the headstock indicates the oil level in the headstock. The gear train to the feed shaft is lubricated by the use of an oil can into spring cover oil cups provided for each bearing. A coolant pump which supplies 7½ gal. of coolant per min. is driven by a belt from the main drive pulley.

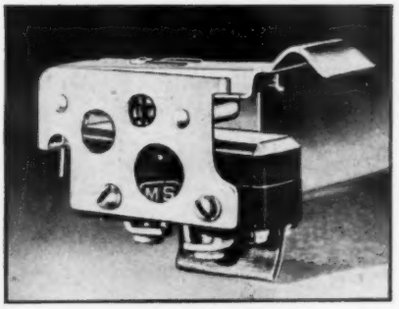
Landis Work Holding Fixture Gives Rigid Threading Support

A special work holding fixture has been announced by the Landis Machine Co., Waynesboro, Pa., for use on its Landmaco machine for the threading of vital components in munitions industries. The fixture provides a means of accurately and rigidly supporting the work piece during the threading operation.

It is fastened to a faceplate which bolts to the machine carriage in place of the customary carriage front or vise. Both horizontal and vertical adjustment are provided on the carriage to give accurate and permanent alignment of the work piece with the center of rotation of the threading unit. The fixture provides a work aligning arbor



on which the work is retained by a collar which fits a square, milled close to the end of the arbor. A lever-operated cam arrangement at the rear of the arbor is used for drawing and locking the work piece onto two driving and locating pins.



Micro Light-Weight Actuator Offers Rugged Protection

A rugged actuator, Type T, for a precision snap-action switch has been brought out by Micro Switch Corp., Freeport, Ill. The metal bracket accepts any Type Z Micro switch. The operating lever provides an overtravel of 1/6 in. beyond the point of switch snap with a positive and well maintained point of operation. The lever at the operating end is $\frac{11}{16}$ in. wide and shaped to easily slide over the operating cam or dog. The assembly may be mounted singly or in gang. The weight of the actuator without the switch is 2 oz.

Smith-Johnson Air Motors Reduce Tool Operation Time

A line of air motors, complete with universal integral valves, for use where powerful reciprocating motion is required has been brought out by Smith-Johnson Corp., 623 East 12 St., Los Angeles, Calif., under the trade name of Senacon. Application of the motor to machine tools saves time in opening and closing vises and holding fixtures, moving work pieces and tools to and from each other, operating clutches and lathes, and similar operations. The valve lever can be linked to a moving part of the machine for automatic synchronous operation, thus reducing rejects by uniformity of power application and eliminating many of the manual motions.

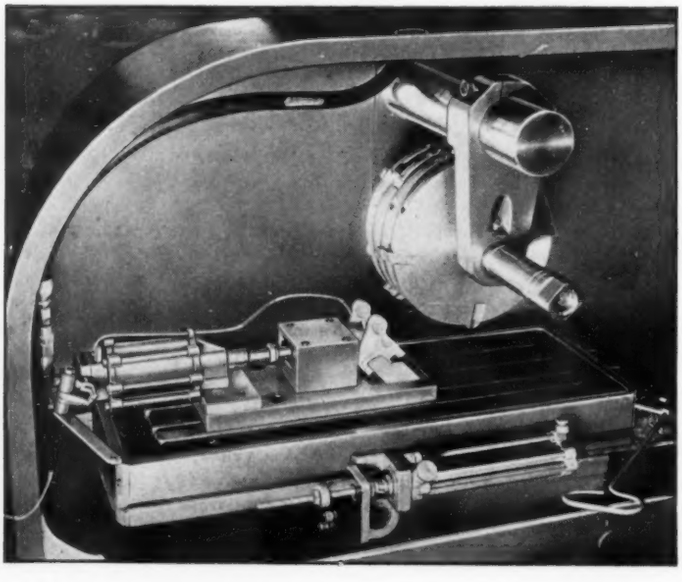
The Senacon motor also serves as a prime mover for supplying fractional horsepower for such operations as punching, broaching, stamping, tube flaring, die casting and bushing insertion.

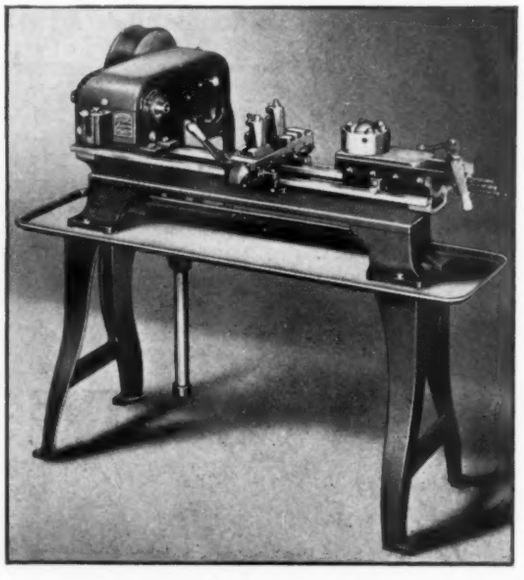
A special feature is the dual exhaust ports which provide for selective utilization of the exhaust air blasts for ejecting work pieces, cleaning out chips and permitting adjustment of speed. The equipment is available with strokes of 1½, 2½, 6 and 9 in. in standard models. Sizes ranging from 1 to 18 in. can be supplied.

Logan Hand Screw Lathe Speeds Small Parts Work

For continuous production of small parts at speed and precision comparable with a larger machine the Logan Engineering Co., 4901 Lawrence Ave., Chicago, Ill., has announced a No. 830 hand screw lathe which has a capacity of ⅝ in. round bar stock.

Features of design and construction include precision ground bed with two prismatic V-ways and two flat ways; precision preloaded ball bearing spindle mounting; turret holes are bored from the headstock; the turret and cross-slide are provided with adjustable gibs to compensate for wear.





Conserving High Speed Steel.....

. . . it's an old story at Genesee

Long before limitations were placed on the use of High Speed Steel (18-4-1), the makers of "Tomahawk" tools were already regularly producing cutting tools made up of H.S.S. tips on soft steel shanks.

Such "Tomahawk" tools were being used in regular production by one of the largest automobile manufacturers, for instance, as far back as 1938.

Production quantities were not large —in those days there was no tungsten shortage—but it did provide Genesee with the essential production background to produce such tools when suddenly needed in quantities.

That has been and will continue to be one of Genesee's policies:— to be ready with new forms of "Tomahawk" quality tools, standard or special, for any set of conditions, — for war or for the peace to follow.

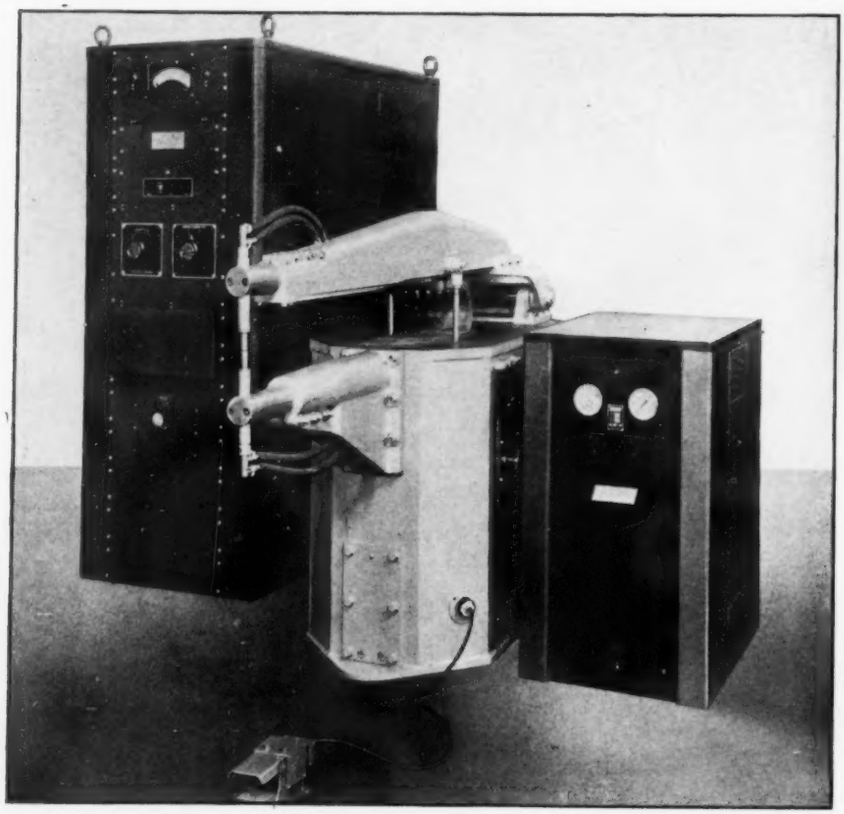
We will be glad to send you a condensed catalog of "Tomahawk" tools, streamlined to present conditions. Ask for Catalog No. GT-42-IA.

* Registered Trade Mark

GENESEE TOOL COMPANY

FENTON, MICHIGAN

Progressive Rocker Arm Welder With Retractable Stroke Includes Revers-O-Charge Control and Frostrode Unit



For welding of aluminum Progressive Welder Co., 3001 East Outer Drive, Detroit, Mich., has made available a rocker arm welder which has a retractable stroke of 9 to 12 in., depending upon the throat depth. Retraction is accomplished by means of a fractional hp. motor driving a leadscrew. The welding stroke ranges up to a maximum of 3 in. The upper and lower arms are slidable and may be adjusted in and out for throat depth, or turned for angle mounting of electrodes.

Point dressing is accomplished by exhausting the return stroke of the air cylinder with a three-way hand valve located on the side of the machine.

Revers-O-Charge capacitor discharge control and a Frostrode refrigerating unit are included with the welding equipment. Any one of eight different charging rates is available at the turn of a tap switch, while two tap switches enable the selection of any number of the capacitor units. Voltage of the charge is controlled by a single knob, and the voltage can be raised and lowered without discharging condensers. All moving elements between the condensers and welding transformers are eliminated in the Revers-O-Charge.

In the pedestal type welding machine the Frostrode unit is built into the base. Electrode refrigeration insures a maximum of heat dissipation at the points where the electrodes contact the work.

Union Metal Inverted Skid Moves and Stores Long Bars

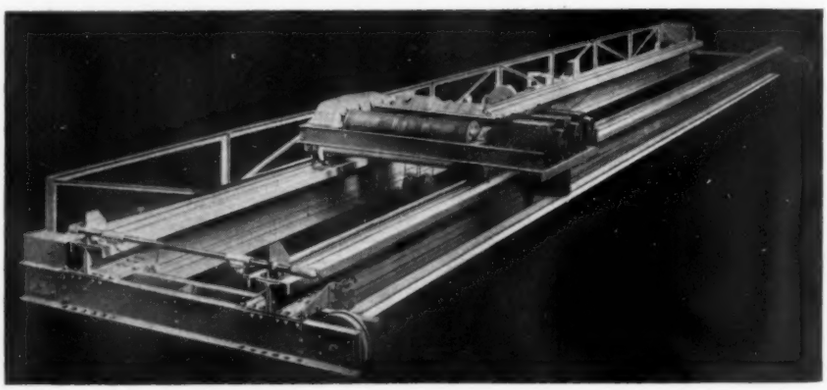
For handling and storing of long bars the Union Metal Manufacturing Co., Canton, Ohio, has announced an open-end inverted skid platform, turned upside down and equipped with eyed brackets for the insertion of crane hooks. It is of corrugated design which provides added strength and durability and can be handled equally well with crane, hand pallet or power fork trucks. The platform is furnished in sizes and types to meet every ordinary requirement.

Conco Low-Headroom Overhead Electric Crane Adjustable for Higher Stacking of Materials

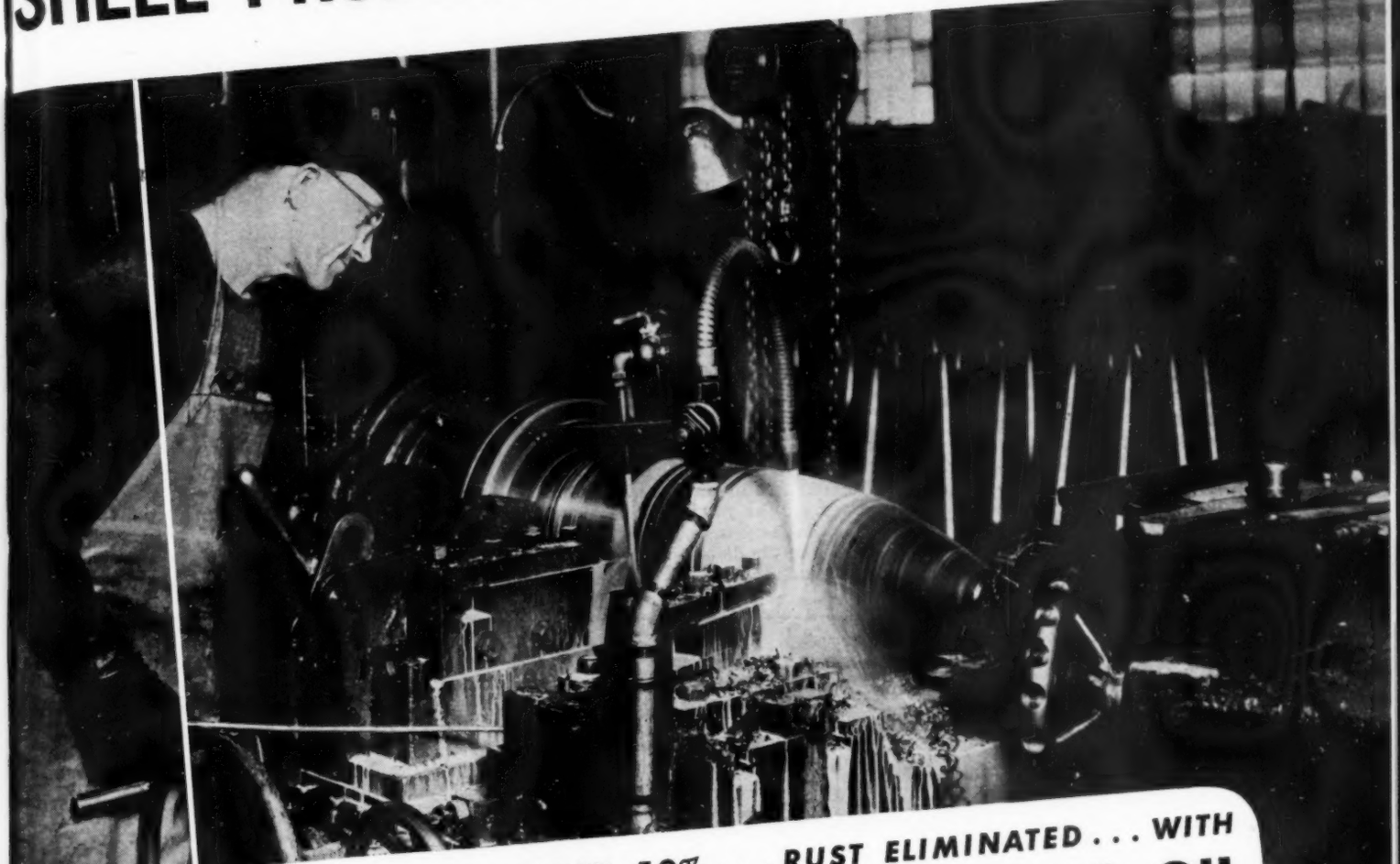
A Type DH low-headroom overhead electric crane has been brought out by Conco Engineering Works, Div. of H. D. Conkey & Co., Mendota, Ill. The low-headroom feature, permitting materials to be stacked higher, is achieved by mounting the drum parallel to the hoist motor and bringing the hook block up between. The trucks have large diameter wheels operating on hardened and ground alloy steel axles. All gearing is machine cut from forged steel blanks, and the gears and holding brake operate in a bath of oil in an oil-tight housing which prevents dust and other foreign matter from entering the oil chamber. The use of positive oil seals eliminates leakage of grease.

Although compact all parts of the hoist are easily accessible and individual parts can be removed without disturbing adjoining members. A maximum distance of hook travel in all directions is provided in the design of the hoist. The hoist motor is equipped with a large solenoid brake and magnetic type limit switch.

Standard foot mounted motors are furnished and any standard type control cab can be supplied. The machine is available in capacities from three through fifteen tons.



SHELL PRODUCTION DELAYS *Blasted!*



TOOL LIFE INCREASED 50% . . . RUST ELIMINATED . . . WITH SUNOCO EMULSIFYING CUTTING OIL

In one of America's largest armament plants, better shells are rolling off the production line faster because of the job Sunoco Emulsifying Cutting Oil and Sun Oil Engineers are doing.

Short tool life and a bad rust condition were retarding production. Tests were made with ten prominently-known soluble cutting oils to determine the best for their purpose. Sunoco was selected. At the suggestion of Sun Oil Engineers — those capable Doctors of Industry — a change also was made in the method of applying the soluble oil. Now tool life has increased approximately 50% . . . and the rust problem is a thing of the past!

This is typical of the service these Doctors of Industry and Sunoco Emulsifying Cutting Oil are rendering to industry in the drive for victory production. Remember these engineers . . . and the products they offer . . . are ready, willing and able to help you boost production in your plant. For helpful case histories of what they have done for other leaders in the metal working industry, write for your free copy of "Helping Industry Help America."

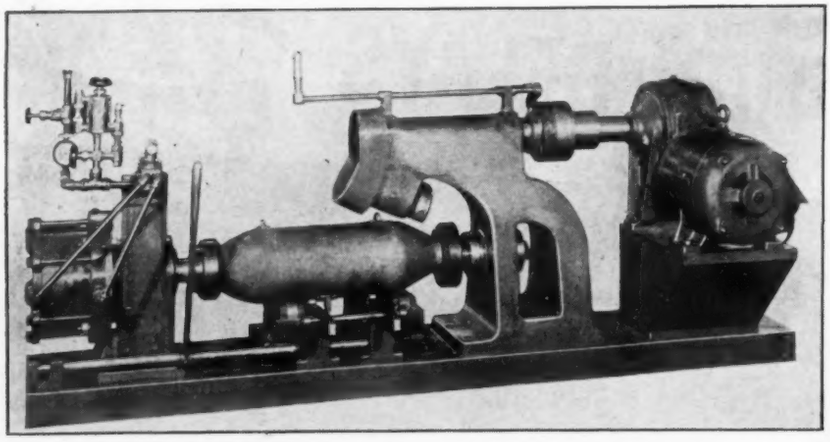
SUN OIL COMPANY · Philadelphia

Sun Oil Company, Ltd., Toronto

BUY WAR BONDS AND STAMPS

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

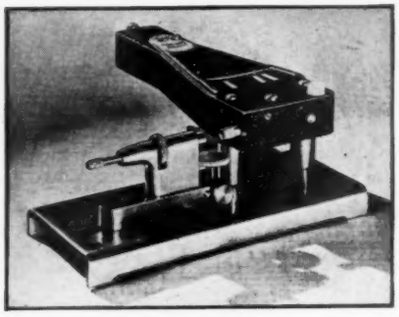


Jas. H. Matthews Semi-Automatic Marking Machine Marks Trail Surface of 100 to 1,000 Lb. Bombs

For marking required data on the conical tail surface of 100 lb. to 1,000 lb. bombs Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh, Pa., has produced the No. 203 bomb marking machine. This is a semi-automatic machine and performs the marking noiselessly. The bomb is rolled into the machine and is held in position by a pneumatic thrust chuck at the nose and by a rotating thrust bearing at the tail. A single revolution clutch is tripped by a hand lever to mark the bomb. A roller die with interchangeable type rotates it and progressively marks the required data in one line of ¼ in. characters on the tail surface. After the bomb has been marked it is then raised from the cradle rolls and allowed to roll from the machine.

Trico Micro-Chek Parts Gage Checks Limits Simultaneously

Use of a simple mechanism of levers to multiply the dimensions and put the device under pushbutton control has been made in the development of a comparator type of gage called a Micro-Chek announced by Trico Products Corp., Buffalo, N. Y. This device is set by the use of two master parts, one having the limit of dimensional



tolerance on the high side and the other on the low side. Two limiting fingers on the instrument are set for comparison of production parts to the master parts to check the production part for its "go" and "no go" limits simultaneously.

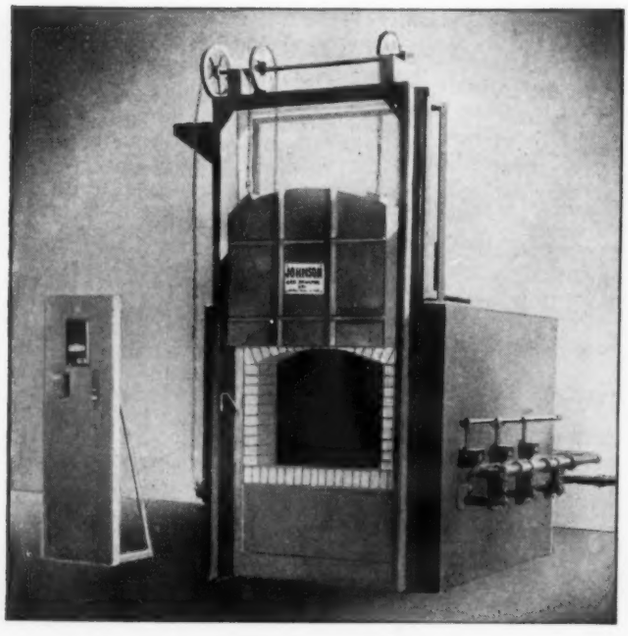
Johnson Heat-Treating Furnace Equipped With Automatic Door

A large heat-treating furnace that produces 2,000 F. has been announced by Johnson Gas Appliance Co., Cedar Rapids, Iowa. This temperature will remain constant throughout operation it is claimed. The unit has inside combustion chamber measurements of 36 in. wide, 60 in. long and 30 in. high, and is lined with 5½ in. insulation and faced with 4½ in. insulating refractory.

Among the unusual features of the furnace are the electrically operated door which raises in 5 sec. and stops automatically, proportioning-type control which automatically regulates the furnace temperature and stack damper position, and pushbutton ignition.

Gorton Spit-Fire Arc Etcher Has Versatile Etching Uses

Announcement of a Spit-Fire Model A-E etcher capable of light or deep etching on flat or irregular surfaces, on concave or convex curvatures, without need of a forming guide, has been made by George Gorton Machine Co., Racine, Wis. It has a self-adjusting vertical movement up to ⅜ in. which automatically follows contours at a speed of 120 arcs per sec. Etching depth is variable by one dial control from 0.0001 to 0.003 in. deep. The etching width is variable by diameter of the electrode used from 0.0075 to 0.015 in. Characters can be varied in height from 1/32 in. to much larger sizes. Operating on 110 to 120 volts, 60



"GET IN YOUR SCRAP—

WE'LL PRODUCE THE FIGHTING STEELS!"

. . . this headline statement is a challenge that comes to you from the thousands of steel workers throughout America. Like the men in your own plant, these steel men are doing their fighting by producing war materials in greater volume than ever before, and they are doing it largely with existing furnaces and machines. Men in steel are determined to hold *their* production records, and even to better them, so that your workers may have the steel they need.

To do this requires scrap and more scrap, and the steel workers look to you to help yourself by helping them get the scrap.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

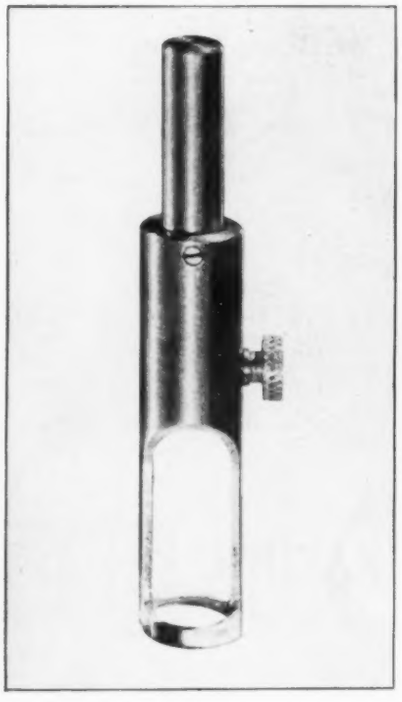
cycles a.c. only, etching voltage is stepped down and is variable from three to nine volts. The equipment is designed for high production etching or individual marking of soft or hard metals.

This Model A-E machine is furnished with a choice of either 3:1 or 6:1 fixed ratio pantograph. Areas covered by the etcher electrode point are up to a 5 in. dia. circle, a 4½×5 in. rectangle, or 4×8 in. long strip for 3:1 ratio; or for 6:1 ratio up to a 3 in. dia. circle, a 2¼×4 in. rectangle, or 2×5 in. long strip. The vertical capacity, spindle to table is to 10 in. with screw and to 13¾ in. without screw. The etcher occupies a floor space of 31×29×44 in.

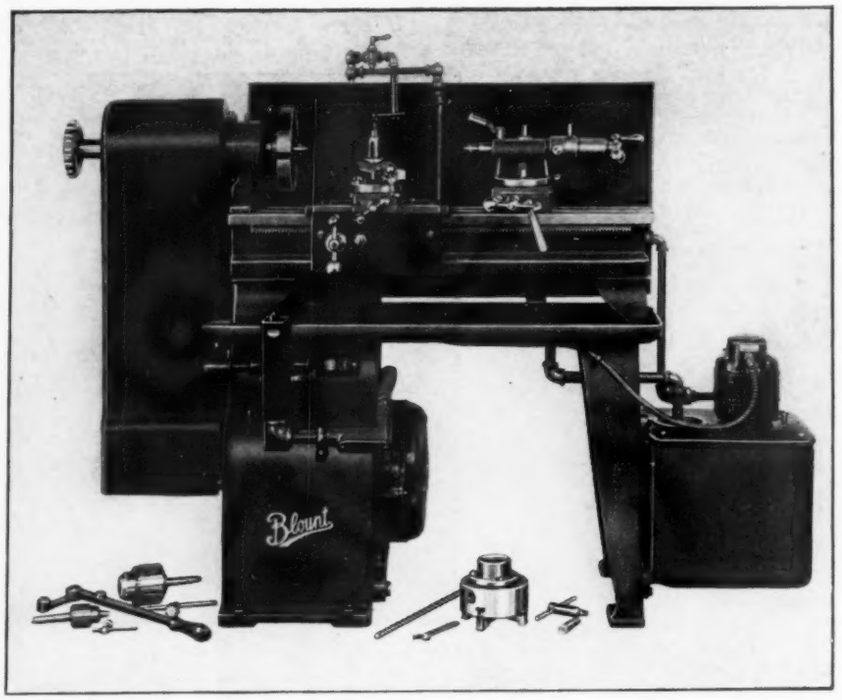
The new Spit-Fire electric arc etcher unit, consisting of etcher head and control panel in a compact carrying case, 7¼×14½×10½ in. high, with built-in transformers, switches, pilot light, cables, extra wire, tube of 36 electrodes in assorted sizes, is furnished as standard equipment with the Model A-E etcher.

Center Master Locating Tool Reduces Work Centering Steps

A locating and centering tool known as Center Master has been brought out by the Center Scope Instrument Co., Center Master Div., 351 S. La Brea Ave., Los Angeles, Calif. This type tool is said to be particularly effective in accurately centering layouts to spindle and reduces the number of steps necessary in locating and centering work to the spindle axis. It is of simple construction and easy to use. The overall length is 3¼ in. with a ⅜-in. spindle shank 1 in. long. The tool is equipped with a knurled trimming screw for compensating run-out.



Blount Headstock-Type Lathe Has 11-In. Swing Over Bed



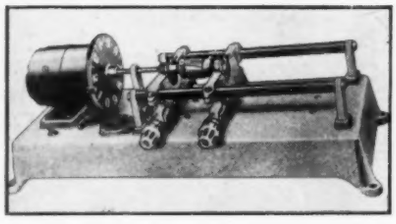
J. G. Blount Co., Everett, Mass., has brought out a Model B-5 ball-bearing headstock-type lathe with ½ hp., four-speed, 11 in. swing by 4 ft. bed, and equipped with a magnetic starter with pushbutton and fuseless disconnect switch. The lathe has a hand feed carriage and compound rest, and full setover-swivel tailstock and V belt drive.

The spindle nose is 2⅜ in. in dia., 10 V threads. Collets from ⅛ to 1 in. capacities can be accommodated in the spindle, and spindle speeds of 360, 510, 680 and 975 r.p.m. can be obtained on this equipment.

A coolant tank 15×12 in. complete with strainer is attached to the end of the lathe, and a ¼ hp. gusher coolant pump is mounted in the tank. A splash guard at the back of the lathe prevents spattering of the coolant outside the lathe. Net weight of this model is 1,365 lb.

Bear Dy-Namic Balancer Makes Static and Dynamic Tests

Elimination of noise and premature wear of shafts, bearings and so forth which result from the excessive vibration of rotating parts caused by couple action are features of the low cost Model 335 Dy-Namic balancing



machine brought out by Bear Manufacturing Co., Industrial Div., Rock Island, Illinois.

Both the angular position and the value or amount of unbalance are shown at the same time on this balancing machine, and it is not necessary to static balance before a dynamic balance test can be made. The machine reveals whether a static or a dynamic unbalance, or both, are present without reversing the ends of the body being balanced.

This is a small bench model machine, size 12×28×10 in. high, with 12 in. width capacity between the supports. In addition to balancing small armatures, blowers, wheels, gears and pulleys the machine is adaptable for balancing of precision rotating parts used in optical equipment.

Allis-Chalmers Electro-Cooler Steps Up Transformer Capacity

An Electro-Cooler recently brought out by Allis-Chalmers Mfg. Co., Milwaukee, Wis., has been designed to save copper and steel and can be built into new transformers or readily applied to those already in service to step up capacity. Because this new cooling unit is relatively small, usually more than one is required, depending upon the size of the transformer. Installation can be made in 3 to 4 hr. without removing the oil in the transformer

RIGIDHOBBER

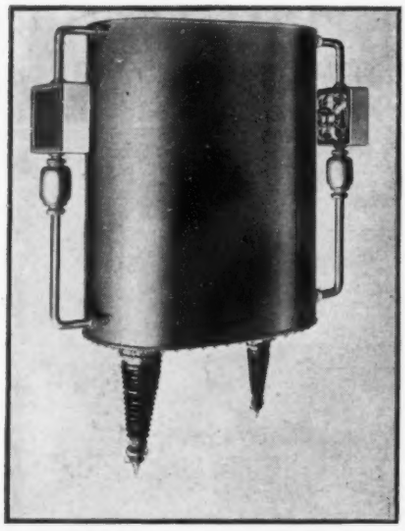
SPECIFICATIONS FOR RIGIDHOBBER 3616

Maximum Diameter Spur Gears	36"
Maximum Diameter Helical Gears	27"
Min. Center Line Work & Hob Arbors	3"
Maximum Hob Diameter	8"
Diameter Work Table	24"
Diameter Index Gear	26"
Rated Max. Dia. Pitch	3"
Floor Space, inc. door swing	54" x 160"
Weight	18,000#

36" DIAMETER 16" TRAVEL 20" LONG

Write!
FOR FURTHER INFORMATION

THE CLEVELAND HOBBING MACHINE CO.
CLEVELAND · OHIO



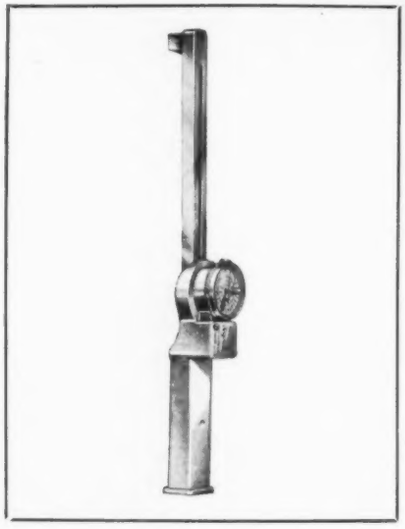
if it is equipped with the conventional type radiator valves.

The cooler consists of a radiator-type cooler and a special pump with motor inclosed. These are connected by piping to the standard radiator valves at the side of the transformer. The motor is self-cooled and self-lubricated, and no stuffing boxes are required in the pump.

Apco Torque Wrench Unit Made In Four Dial Sizes

A torque wrench announced by Apco Mossberg Co., 108 Horton St., Attleboro, Mass., is made in four dial sizes. The unit measures up to 150 in. lb. of tension on an outside scale, first revolution and up to 250 in. lb. on an inside scale, second revolution. Other calibration ranges are up to 600, 1,200 and 2,400 in. lb. respectively. Because the dial graduates are larger and more widely spaced reading is quicker and easier.

The dial is set in a special housing inside an extension of the handle which gives better protection from shocks and knocks.



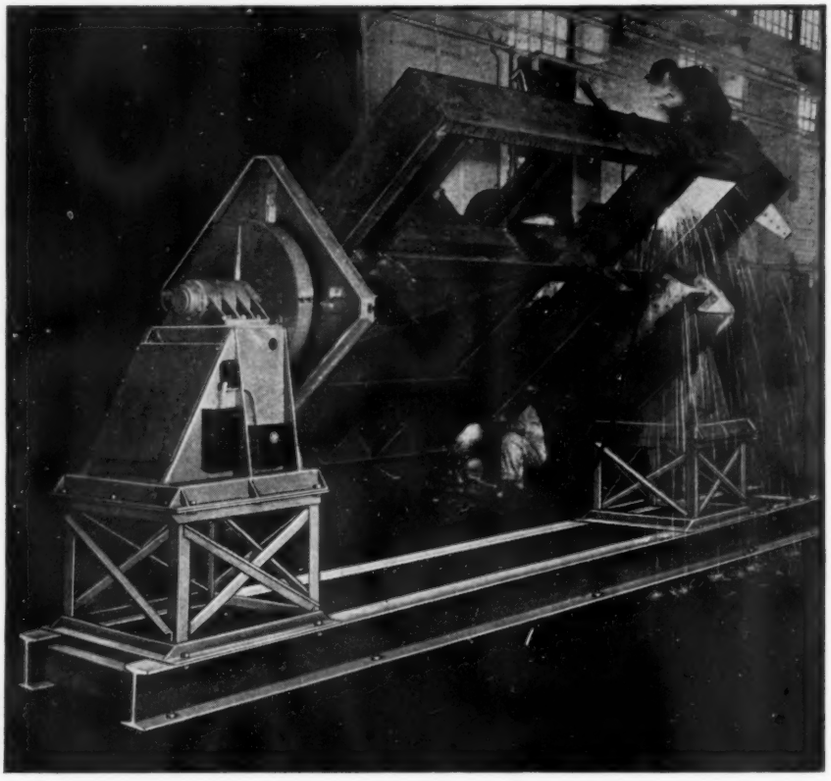
Ransome Headstock and Tailstock Welding Fixture Facilitates Position-Welding of Large Pieces

A rotating welding fixture consisting of a headstock and tailstock combination has been produced by Ransome Concrete Machinery Co., Dunellen, N. J., for position-welding large cumbersome objects.

The headstock table top is fixed in a vertical position with its spindle shaft turning in double roller bearings. Power for rotating this unit is provided through a pinion in mesh with the table top ring gear. The driving motor and self-locking gear reduction are completely inclosed within the main frame.

The tailstock is essentially of the same design and construction as the headstock, but is not provided with power, and functions as an outboard holding fixture. To accommodate objects of different lengths the distance between the headstock and tailstock is made variable, by mounting the tailstock on heavy I-beams and moving it to accommodate the part to be welded. Height adjustment is accomplished by providing simple sub-bases to suit the conditions of service. Where a difference in elevation between the headstock and tailstock units is desired to provide additional downhand welding positions, the main base of the units is pivoted at one end and provided with a hydraulic jack at the other.

The headstock and tailstock are of heavy all-welded construction, and table tops are T-slotted to facilitate clamping. The fixtures are made in various standard sizes to handle objects up to 16 tons.



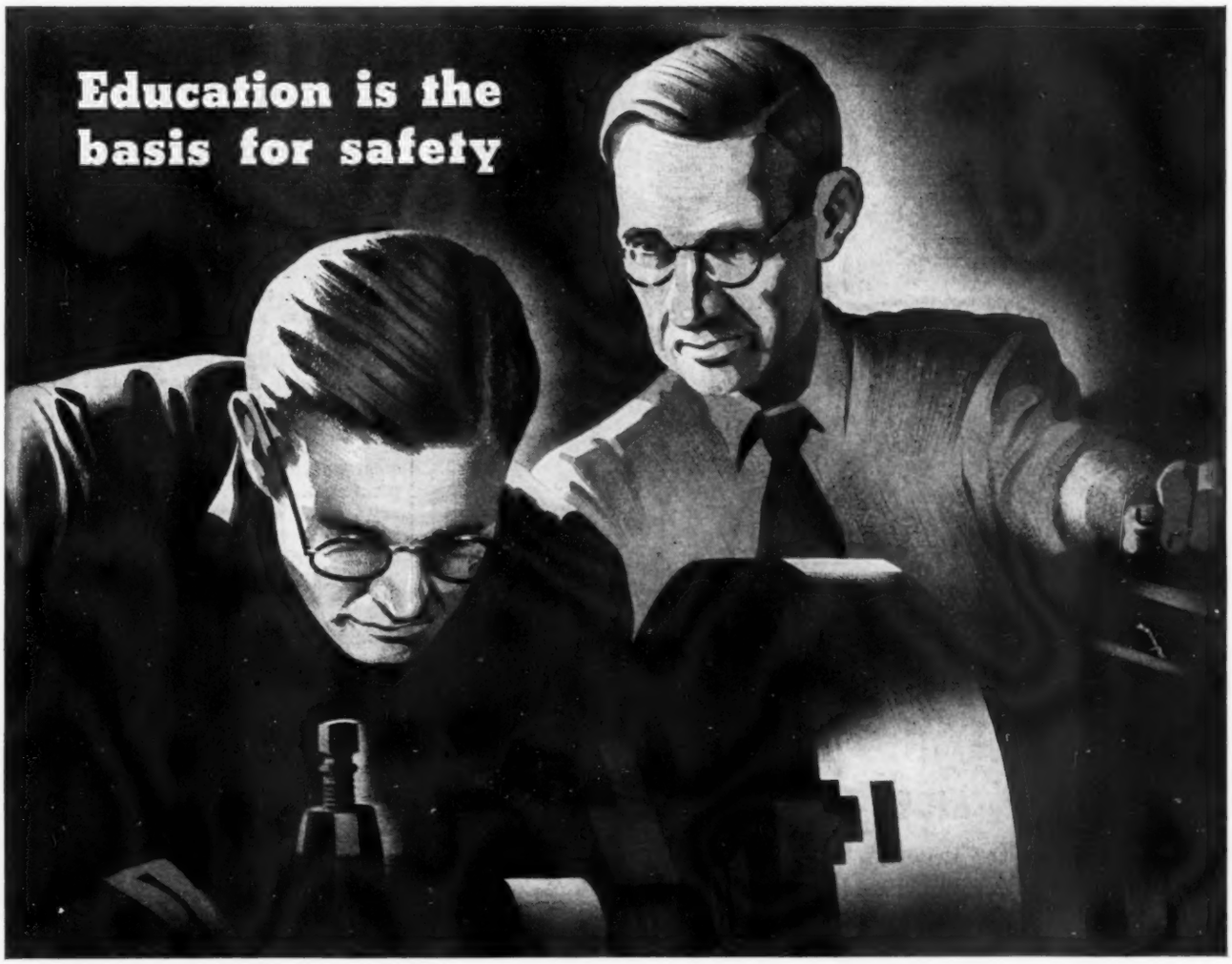
Amesacks Bags Handy for Shipping Small Parts

For packing and shipping small parts the Ames Bag Co., 1991 E. 66th St., Cleveland, Ohio, has available cotton bags called Amesacks. For separate shipping of small parts these bags come equipped with either shipping tags or complete envelopes. The envelope type is used if a letter is to be sent with the shipment.

A time-saving plan for use on the assembly line has been found to expedite assembly operations. By marking contents of the tag plainly it can be placed in proper place on shelves along the line when received and can be selected without delay for the job on which the particular part is required.

Burcott White Wiping Cloths Have No Foreign Substances

Wiping cloths entirely free from foreign substances have been developed by Burcott Mills, 616 W. Fulton St., Chicago, Ill. They are bleached to a hospital whiteness. The cloths are available in different sizes and weights, depending upon the job for which they are to be used.



Information supplied by the National Safety Council

Labor, particularly inexperienced labor, cannot be expected to recognize the full penalties of carelessness in the shop. Management has assumed the responsibility of supervising safety measures, and has cooperated in establishing sound safety rules.

Nevertheless, the large increase in labor personnel due to war needs, plus the influx of inexperienced men, have resulted in a substantial increase in lost time accidents.

Even assuming that the obvious safety measures with regard to operating machinery, electrical equipment and shop traffic have been installed, two factors — education and eternal vigilance — determine the real effectiveness of any safety program.

Both are the responsibility of the supervisory staff, from foremen up. The foreman who does a thorough job of educating his particular group in safety rules and cooperative enforcement has done much to cut down accidents. Management that takes an active interest in both safety education and the enforcement of safety measures has taken a great step forward in reducing wastage of irreplaceable production time.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Mo-lyb-den-um Company
500 Fifth Avenue • New York City

MOLY

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

STANDARD REAMERS
available from stock

WE LIST as STANDARD many cutting tools formerly in the so-called "special" class. Better yet, the majority of these standard cutters is in stock most of the time. Our line is broad enough to often permit consolidation of tool orders thereby saving valuable time.

Cemented carbide tools are our *specialty*. We make them *exclusively*. Each tool is tipped with the *correct* grade of CARBOLOY best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

You can expect and get uniform, high quality results with Wendt-Sonis tools. Catalog 142 mailed FREE upon request. Ask for it! WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

Wire or phone your requirements and priority rating.

W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ½ to 1½.

W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

WENDT SONIS
CARBOLOY CUTTING TOOLS

CENTERS ★ FLUTE DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

NEW MATERIALS

Surbrite Surface Conditioners Produce Bright Smooth Surface

A steel surface conditioner called Surbrite has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J. It is a free-running powder prepared in two types for addition to hydrochloric acid and sulphuric acid pickles. Used in small quantities as additions to regular acid pickles it produces bright, smut-free surfaces when iron and steel are pickled.

Surbrite H at 0.5 percent the weight of 40 percent hydrochloric acid leaves steel bright and smooth after 15 min. pickling at 110 F. it is claimed. Surbrite S at 0.5 percent the weight of 10 percent by volume sulphuric acid is said to perform satisfactorily up in the 140 to 160 F. range.

Hands Protected With Cadet Waterproof and Greaseless Cremes

For protection of skin against grime, all non-water carrying substances and clogging of the pores the Cadet Creme Co., 151 Farrar Ave., Worcester, Mass., has brought out a Protector creme. It is a greaseless, velvety-textured cream which dries on the skin in an unseen film and lasts at least four hours. Removal of the creme requires simply a small quantity of water.

The company has available also a waterproof creme for workers whose hands are exposed to acids, alkalis, caustics and liquid solutions where rubber gloves would ordinarily be used. For removing this creme the Protector Creme is applied and then slowly rinsed off with hot or cold water.

American Silver Solder Flux Produces Non-Porous Bonds

Introduction of a silver solder flux paste has been made by American Products Corp., 422 S. Dearborn St., Chicago, Ill., which is adapted for brazing and silver soldering cutting tool metals to tool shanks. The flux is also suitable for nickel silver and all non-ferrous metals. It acts as a cleansing agent, floating all oxides to the surface. Strong, non-porous bonds are produced between cutting tips and tool shanks. The paste is packed in 1 and 5 lb. glass jars.

Bound Brook Powdiron Alloy Adaptable to Parts, Bearings

Powdiron, adaptable to both parts and bearings as a substitute for critical, restricted materials, has been announced by Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. This material is available either with or without lubricant impregnation, with up to 25 percent oil content. Three formulas are

provided for a wide variety of operating conditions and applications. Specifications include porous iron alloys containing no tin and copper from 0 to 10 percent maximum.

Stewart Gas Welding Flux Has Free-Flowing Feature

A Flo-Ez-Flux for gas welding of wrought, cast or high tensile aluminum and aluminum alloys has been announced by Park Stewart, 1005 Carbis St., Worthington, Pa. It is claimed that this free-flowing flux will not solidify or deteriorate. The material is packaged in a glass container, which prevents corrosion and protects it from moisture, and is available in sizes ranging from ¼ to 25 lb.

TRADE PUBLICATIONS

BLOWERS A catalog on single inlet blowers, both direct and belt driven, for supplying air or for exhausting purposes, is offered by The Lau Blower Co., Dayton, Ohio. It includes performance data on the available three different series in a wide range of wheel diameters.

CONVEYORS Gravity and power conveyors, engineered to meet package handling problems, are described in catalog No. 307 of the Standard Conveyor Co., North St. Paul, Minn.

COOLANT PUMPS An 8-page brochure in color, illustrating the "Gusher" coolant pumps, is offered by the Ruthman Machinery Co., Cincinnati, Ohio.

ELECTRIC CONTROLS Control centers are described and illustrated in a 20-page bulletin issued by the Trumbull Electric Mfg. Co., Plainville, Conn.

ILLUMINATION Adjustable lighting units are described and illustrated in Bulletin No. 108, recently issued by the Steber Manufacturing Co., 2451 N. Sacramento Ave., Chicago, Ill.

LABOR ARBITRATION The American Arbitration Assn., 9 Rockefeller Plaza, New York, N. Y., has made available without cost its recently published booklet, "Labor Arbitration in Wartime."

LIGHTING Curtis Lighting, Inc., 6135 W. 65 St., Chicago, Ill., is distributing a new 88-page catalog No. 42, describing their latest equipment. Included are specifications, foot-candle data, coefficients of utilization charts, equipment spacing, prices and other essential information.

LIGHTING A new fluorescent lighting fixture catalog is being offered by Sylvania Electric Products Inc., (formerly Hygrade Sylvania Corporation),

Saw-way MULTI-PURPOSE INTERNAL GRINDER

Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6″ . . . grinds holes ¼″ to 18″ in diameter . . . holes up to 9″ deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

Distributors throughout the U. S. and Canada to serve you.

Saw-way TOOL AND MACHINING CO.
13842 JOS. CAMPAU AVE. DETROIT, MICHIGAN

BIGGER WARTIME PROBLEMS AND MORE OF THEM

Each day of war brings tougher problems.

An army of questions stands at Management's door clamoring for attention . . . Prices? Wages? Variable Costs? Fixed Costs? Taxes? Marginal Income? Break-even Point? Conversion Processes? Priorities? Critical Materials? . . . and PROFITS?

And at no time in the history of business has there been greater need for specialized experience in gathering and organizing the necessary facts and figures . . . and in focusing these data on the problems in hand to GET QUICK ACTION!

Few company organizations have within their own experience all the knowledge required for the process of conversion to new products. Yet, there is available to all business, a store of experience in management engineering which can be quickly applied to any urgent war production activity.

A discussion as to how Trundle Engineers serve their many clients in such capacities and how they might serve you, will involve no obligation.

Geo. D. Trundle Jr.

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

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CHICAGO · City National Bank Bldg. · 208 S. La Salle Street
NEW YORK · Graybar Building · 420 Lexington Avenue

Ipswich, Mass. Over thirty models are illustrated, complete with technical specifications, and a list of recommended minimum standards of illumination given, along with information on planning a fluorescent installation.

LUBRICANTS Scientific Lubricants Co., Dept. U, 3462 N. Clark St., Chicago, Ill., has issued a descriptive bulletin on the usage of Motor-Mica, and describes many operations where it can be used. Detailed mixing instructions are included.

MAGNETS Bulletin No. 25-C, issued by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., describes the design and construction embodied in their suspended magnets, illustrates their application and contains specifications on circular and rectangular types.

MATERIAL HANDLING The Lo-Hed Hoist Div. of the American Engineering Co., Philadelphia, Pa., has issued a pocket-sized folder, "Lo-Hed, the Balanced Hoist". A condensation of the complete catalog, it gives the essential specifications of Lo-Hed hoists.

MATERIAL HANDLING The Euclid Crane & Hoist Co., Euclid, Ohio, has issued four circulars describing their products and illustrating recent installations.

MEASURING Carl Zeiss, Inc., 485 Fifth Ave., New York, N. Y., has issued three pamphlets describing, respectively, "Feather-Touch Vertical Measuring Machine," "Passameter 1" and "Binocular Headband Magnifier."

MILLER Linley Brothers Co., Bridgeport, Conn., has issued a leaflet describing a high speed vertical milling machine and jig borer, to which certain improvements and enlargements have been made.

OIL The importance of using the proper type of lubricant for each job is stressed in a booklet, "Helping Industry Help America", published by the Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.

PLASTICS "Vinylite Resins, Their Forms, Properties and Uses" is the title of a new 20-page illustrated booklet released by the plastics division, Carbide and Carbon Chemicals Corp., 30 E. 42 St., New York, N. Y. It describes briefly the four major types of vinyl resins and the various plastic materials produced from them and includes tables of properties as well as charts showing the principal applications.

SALT BATHS The use of molten salt baths for heat treating in case hardening of steel is described in a 72-page illustrated manual published by the Electrochemicals Department of E. I. du Pont de Nemours & Co., Wilmington, Del.

SANITATION A new 16-page illustrated manual, published by Oakite Products, Inc., 24 Thames St., New York, N. Y., discusses effective, wartime sanitation in metal-working plants.

SCREW THREADS "How to Cut Screw Threads in the Lathe", a 21-page booklet covering the cutting of screw threads on back-geared screw-cutting lathes has just been reprinted by the South Bend Lathe Works Dept. A8, South Bend, Ind. Information is given on the various types of lathe tools employed in cutting screw threads, how to grind them, and how they should be mounted and positioned. 10 cents.

STEEL Precision Steel Warehouse, Inc., 2315-2335 West Hubbard St., Chicago, Ill., has issued a folder describing Precision brand cold rolled strip steel.

STOP NUTS 415 items of elastic stop nuts have been reduced in price by Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J., according to a folder offered.

TAPPING A catalogue describing high speed air-controlled tapping machines, giving details of construction and capacities, and including considerable information on the design and use of holding fixtures available for increasing their production capacity, has been issued by the R. G. Haskins Co., 2761 W. Flournoy St., Chicago, Ill.

THREAD GRINDING A folder discussing the problems of thread grinding has been completed by the Macklin Co., Jackson, Mich.

TIMERS Catalog No. B10, issued by Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa., describes and illustrates their series 2800 "Vernier-Set" and "Cycle-Progress" Timers. Wiring diagrams, tables, electrical data, case drawings and illustrations are included.

WEIGHING Balances for accurate and rapid repeated weighings of small particles ranging from less than 3 mg. to more than 50 grams are described, illustrated and listed in catalog No. 4550 recently issued by the Roller-Smith Company, Bethlehem, Pa.

NEW BOOKS

JOB TRAINING UNITS—*Prepared by the staff of the William Hood Dunwoody Industrial Institute. Published by the American Technical Society, Drexel Ave. at 58 St., Chicago, Ill.* $1.25 *each.*

These new units of the Dunwoody series cover welding training. One covers gas welding training units, and the second deals with arc welding training units. Each has been developed

WHATEVER his combat branch, the American soldier, sailor or marine knows his weapon from A to Z. He knows exactly what his rifle or machine-gun or artillery piece will do, how to maintain it at peak efficiency, how to take it apart and put it together again under the most adverse conditions.

IF a McCROSKY SUPER REAMER is one of your weapons in this war, you'll be helping your plant's production and Uncle Sam by knowing that weapon from drive slot to cutting edge, by knowing how to keep that weapon in "fighting trim."

There's a free new McCROSKY REAMER MANUAL to help you be an expert with your weapon. In short, simple language, this illustrated manual covers the basic principles of the inserted-blade reamer, the fundamentals of reamer grinding and maintenance. It will help you do top work and at the same time insure the maximum efficiency and long life of the tool.

E.S.T. 1904
McCROSKY TOOL CORPORATION
MEADVILLE, PA.

WRITE NOW FOR

McCROSKY REAMER MANUAL

FOR *accuracy*
CADILLAC
THREAD
PLUG GAGES

As specialists, we manufacture thread plug and ring gages for checking National, Whitworth and special form threads from your smallest size requirements to fifteen inches in diameter. Special thread checking fixtures and thread alignment gages are built to customer's design. Orders and re-orders from the largest armament manufacturers testify to the accuracy of CADILLAC Gages. *Let us serve you! !*

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★ MANUFACTURERS of
THREAD PLUG
AND RING GAGES
AND OTHER THREAD
CHECKING EQUIPMENT

Cadillac
OF
DETROIT

and tested by the staff of the Metal Trades Department of the William Hood Dunwoody Industrial Institute and other cooperating schools and agencies. They have been used in the actual training of thousands of students in the regular vocational schools and in war training programs.

The volume on gas welding consists of 92 pages giving general information on gas welding procedures and instructions for 40 practical exercises for the student. Each of the exercises is complete in itself, with full information being given about the job to be done, and the steps to be followed.

Of similar arrangement, the volume on arc welding comprises 103 pages of practical information on arc welding procedures, including instructions for 40 exercises designed to train the student in the practical aspects of various arc welding jobs. Available for each volume is a set of job check sheet answers for the instructor of a class in welding.

•

PERSONNEL SELECTION BY STANDARD JOB TESTS—*By Charles A. Drake, formerly head, methods department, United Merchants and Manufacturers Management Corporation.* 147 *pages. Published by the McGraw-Hill Book Company,* 330 *W.* 42 *St., New York, N. Y.* $2.

Industry today is faced with a personnel problem more difficult of solution than any in its history. Those plants which are engaged in production of war material are being called on to increase production rates to levels heretofore considered impossible. At the same time large numbers of trained employees are being withdrawn from industry by Selective Service for induction into our armed forces. Not only must industry replace these skilled and semi-skilled production workers, but additional workers must be employed to make possible the vastly increasing production schedules demanded.

Too often the selection of prospective employees is based to a large extent on the personal judgment of the interviewer. In recent years more thought has been given to the development of practical ability tests of the type described in this book. More extensive use of such tests will be essential if we are to make the best use of our available labor supply.

Mr. Drake's book discusses a new technique for the selection of industrial personnel that has been in the process of development since 1937. It consists primarily in designing special performance tests that embody the essential elements of dexterity and perception discovered by the analysis of an industrial job or the analyses of a group of similar jobs. The method is still neither complete nor all-embracing. Nevertheless, the author contends that at this stage in its formulation it offers a realistic and practical

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A LUBRICANT
of
INCREASED
LOAD
CARRYING
CAPACITY
use
"STURACO"
EXTREME PRESSURE ("EP")
MACHINERY
OILS & GREASES

HERE is the answer to many of your lubrication problems caused by today's production demand of heavy loads, high speeds, and continuous operation of machinery and machine tools. "Sturaco" EP Oils and Greases, without any change in your accustomed viscosity or consistency, offer a minimum of *300% increased load carrying capacity* with notable low torque.

Lubrication of ways—spindle bearings—gear heads—elevating screws—speed reducers—are typical examples where "Sturaco" application has solved tough lubrication problems. If you need help, write or phone today.

● SEND FOR the new "Sturaco" booklet outlining laboratory research behind this genuine development, describing typical applications and listing various grades.

For All
Cutting Fluid Problems
D. A. STUART OIL CO.
LIMITED
Chicago, U.S.A. Est. 1865
Warehouses in All Principal Metal Working Centers

method for the selection of personnel to a greater extent than anything heretofore available.

The procedures described imply that the individual who undertakes to use this technique must have a working knowledge of time and motion study, of machine design, of industrial psychology of the conventional sort, of human anatomy and physiology, and of elementary statistics. Any competent employment or personnel worker possessed of adequate training and ingenuity should be well equipped to administer such a program for the selection of employees.

The tests recommended by the author are designed from time- and motion-study data. This gives assurance that a properly designed test will select those who have in highest degree the innate capacities for the job, or related jobs, from which the design data are derived. By a technique of converting raw scores into percentage efficiency scores, it is claimed by the author to be possible to make a forecast of the eventual performance of the testee on the job for which the tests are designed. It is, therefore, possible by this procedure to establish an objective toward which the accomplishment of the individual on the job may be directed. Also, since percentage efficiency scores may be used s a basis for predicting success on the job, the same measure will serve as a criterion against which to measure the success of supervision, and of management generally, in facilitating the indicated achievement.

Experience thus far has shown that it is possible to design a standard battery of three dexterity tests and two perceptual tests that will cover a large proportion of jobs in industry. These tests will be better than any combination of pencil-and-paper tests and other tests of a more pronounced psychological character. Another line of development will include the construction of special tests where the number of jobs involved and the nature of the work justify this initial effort and expense. Such tests, designed from the results of time and motion studies and other techniques will be better instruments of selection than any of the more general standard job tests.

What Is Skill?

By JOHN R. GODFREY

Young Tom Johnson is following in his dad's footsteps in many ways. The Chamber of Commerce of Jonesburg was having a seance on the question of skilled and unskilled labor. How can you determine where to draw the line? What is skilled and unskilled labor from the wage point of view? Here is Tom's definition.

"Roughly speaking, you pay unskilled labor for what it *does*, skilled labor for what it *knows*. Of course, what a man knows doesn't do you any good unless

LUFKIN

INSIDE MICROMETER CALIPERS

FOR BETTER "BALANCE AND FEEL"

For taking exact inside measurements Lufkin Inside Micrometers out-perform all others. Available in sets for taking accurate measurements from 1½" to 40".

Being of hollow steel tubing the measuring rods are light in weight, yet very rigid. The rods can be added to either or both ends of the micrometer head. The head can be kept in the center for better feel, easier adjustment and best reading position.

Rods are adjustable by means of a hardened and ground plug at one end to allow for wear.

For complete facts about these or any other Lufkin precision tools see your distributor. Write for catalog.

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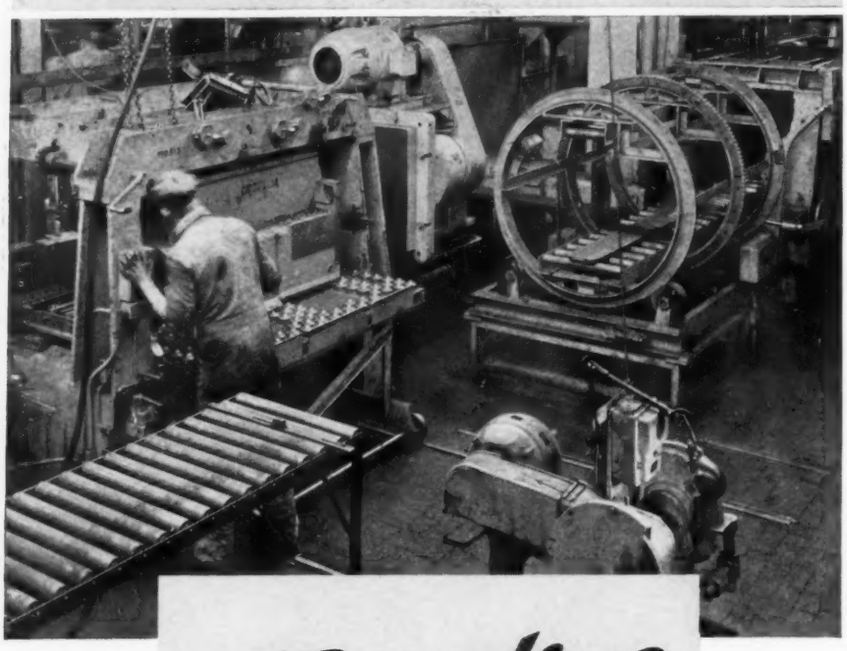
SAGINAW, MICHIGAN · NEW YORK CITY

TAPES · RULES · PRECISION TOOLS

MATHEWS CONVEYERS FOR MECHANIZED HANDLING



Speeding
THE TOOLS OF
Victory

● TIME WAS NEVER MORE PRECIOUS than in this national emergency. Every step that can be saved . . . every unnecessary motion that can be eliminated . . . every ounce of energy that can be conserved helps to speed the tools of victory.

Keeping munitions, materials, and machinery supplies moving faster and with less worker fatigue is the function of Mathews Conveyer Systems.

Mathews engineers have helped hundreds of manufacturers of war material speed up production schedules with no increase in man-and-machine hours!

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.
MATHEWS CONVEYER CO.
Ellwood City, Penna.

he does something with his knowledge.

"So let's put it another way. You pay skilled labor not only for what it actually does but for what it can do. When a toolmaker drills a hole in a die he is perhaps earning no more than an unskilled man on a drill press. But his "know how" makes it possible to go ahead and finish the die, which the drill press man couldn't do.

"Your operator on an automatic screw machine produces only while he keeps the stock going through the machine. You pay him for what he does. The setterup actually produces mighty little work. You pay him because he *knows* how to set up the machine and make it run if anything goes wrong.

"We too often pay him less than his worth just because we can't see what he produces. We might define the skilled man as one who knows how to keep the operators at work. Not from the executive angle, of course, but providing him with the tools and adjustments necessary for his production."

There may be better definitions but I haven't heard them. Of course, we have operators with different degrees of skill. But they get paid for their skill in the amount they produce. This still leaves the idea that we pay skilled men for what they know how to do, as a pretty fair way of expressing the difference.

Perhaps someone has a better notion!

Materials Saved by Design Changes

Savings of millions of pounds of critical materials have been accomplished by General Motors engineers and production experts through changes in designs and processes and through substitutions of less critical metals.

Case histories from General Motors plants reveal savings effected in requirements for steel forgings, armor plate, armor castings, copper, nickel, chrome, rubber and other materials in which there are shortages or in which shortages impend. Lumped together, these savings account for a very considerable diminution of the flow of raw materials from mill to factory.

Here are a few examples of material saving in connection with General Motors production:

Until recently one part of an anti-aircraft gun had to be whittled down from a 56-lb. solid steel forging to a 6-lb. hollow slotted cylinder. Then engineers of G.M.'s Pontiac Motor Division suggested that the forging be replaced by steel tubing which could be welded to a forged base. Result: a saving of 42 lb. of expensive steel scrap per part.

Guide Lamp Division perfected a method of drawing Army truck headlamp reflectors from steel instead of brass. The new method uses 78,000 lb. of steel and 5 lb. of aluminum per 100,000 vehicles, while the old required 65,000 lb. of copper, 32,000 lb. of zinc, 275 lb. of nickel and 160 lb. of silver for the same number of headlamps.

(*Continued on adv. p.* 71)

Speed Up GUN BARREL INSPECTION

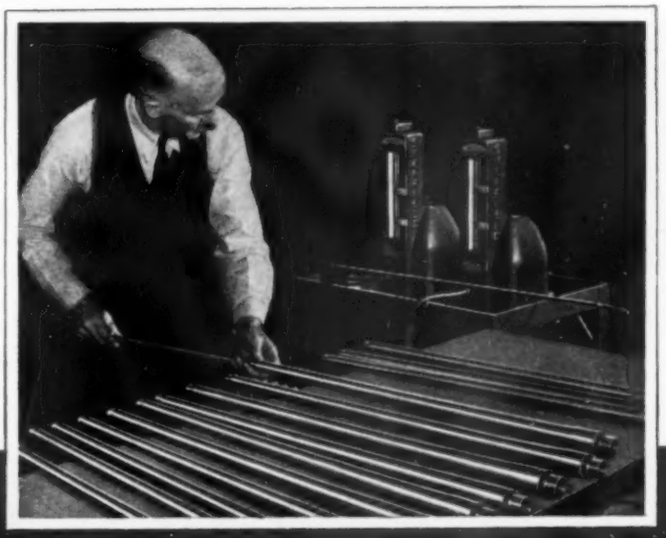
In just one pass through a gun barrel the Sheffield Precisionaire tells the inspector whether or not the bore is within prescribed tolerance or, if not, whether it is oversize, undersize, out-of-round, or bell mouth —also exactly at what point any dimensional discrepancy occurs.

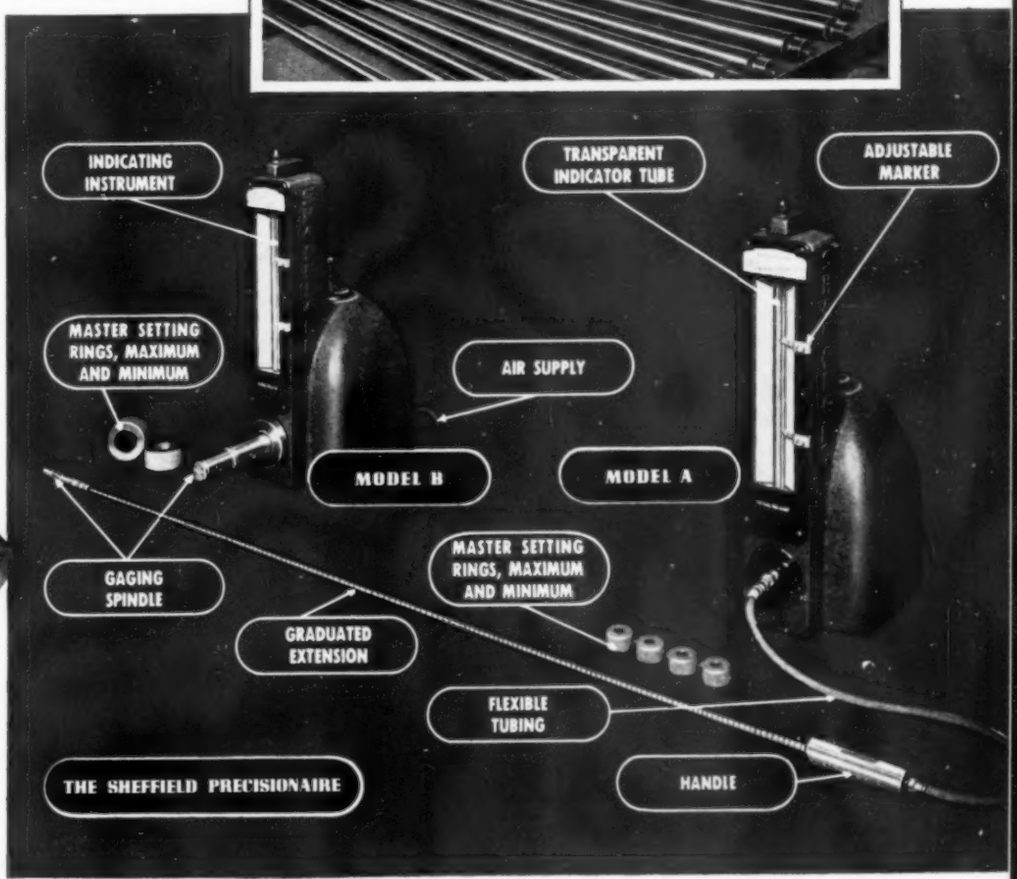
It takes no longer to inspect a gun barrel than it does to push a cleaning rod through it and no more skill, in spite of the fact that the Precisionaire is accurate to .0001". Any new operator having no previous experience can be taught to handle this gage in less than fifteen minutes.

Contrast this speed and this accuracy with inspection by previous methods which were not only slow but which required the highest order of gaging skill in order to maintain accuracy.

The same instrument provided with two slightly different gaging spindles is used to check the bore before rifling and then, by changing the spindle, give it a final inspection after it is rifled.

The Precisionaire, while it is being used extensively for gun barrel inspection, has a number of other very important uses all described in bulletin 42-23. Write for your copy now.





THE SHEFFIELD CORPORATION

DAYTON, OHIO, U. S. A.

SHEFFIELD GAGES MASTER GAGEMAKERS

. . . is Vital to Your War Production Program

YOUR plant is vital to the war production program because of its specialized ability to produce its particular products. The specialized ability of the thousands of American factories has created the world's greatest war production machine . . . in an incredibly short time.

We are specialists in our business. Our specialized experience, ability, and equipment are engaged in the production and servicing of *only one item of equipment—air control valves.*

Ross Air Control Valves are vital in keeping production rolling at wartime speed . . . in plants where guns, tanks, ships, planes, bombs, and ammunition are made. Undoubtedly air control valves in your plant are doing their part in helping to maintain day and night war production.

Because we are air control valve *specialists,* we, too, have an important job. Right now, that job is to help you keep your air control valve equipment functioning at peak efficiency . . . under the strenuous strain of wartime operation. Whether your equipment utilizes Ross Air Control Valves or air control valves of any other make, our service is at your command. A nation wide service organization of trained Ross engineers stands ready to bring you a quick solution to your air control problems . . . saving you precious man hours and priceless machine hours.

Keep your production humming its song of Victory by bringing your air control problems to us. Write, telephone, or wire. *By helping you do your part, we can do our part.*

ROSS Operating VALVE CO.

6489 Epworth Boulevard . . . . . Detroit, Michigan

(*Continued from page* 1274)

Totaling up all its substitutions in the case of lighting equipment for military vehicles, Guide achieved the following savings per month: 21,000 lb. of copper, 12,000 lb. of zinc, 6,000 lb. of rubber, 2,300 lb. of chrome steel, 240 lb. of aluminum and 135 lb. of nickel.

Chevrolet found it possible to reduce the thickness of the copper rotating band on shells without affecting performance, secured War Department approval for the change, and effected a saving in copper that amounts to 65,000 lb. per million shells.

In the case of Army trucks Chevrolet estimates that alternate materials developed by its engineers have saved 5,000,000 lb. of crude rubber, 1,200,000 lb. of nickel, 500,000 lb. of copper, 200,000 lb. of chrome, 125,000 lb. of latex and 70,000 lb. of tin for every 100,000 vehicles produced.

Delco-Remy Division has redesigned battery grids so that only 7 percent antimony alloy is used instead of the former 11½ percent material.

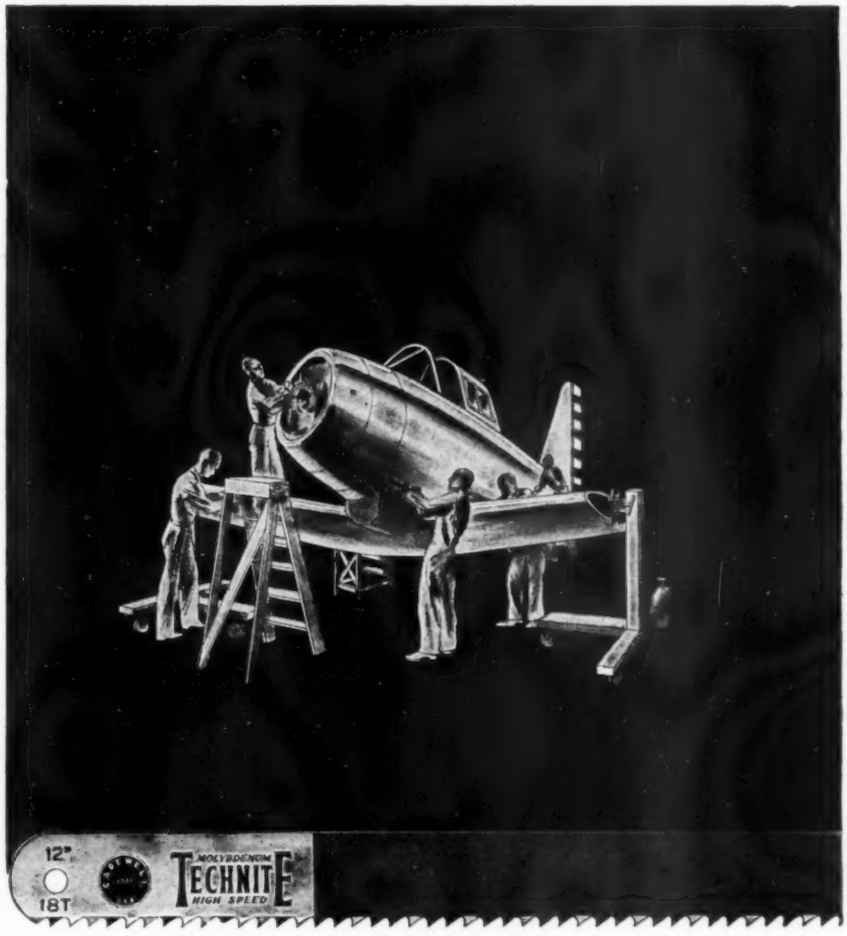
One hundred thousand pounds of bronze per year is being saved by Delco Products merely by eliminating two bronze bushings in shock absorber castings for Army trucks. The castings are now bored to finished bearing size. The same division now saves 3½ lb. of aluminum on each integral horsepower motor it makes as a result of redesigning the rotor, using copper bars for conductors and making the fans of cast iron.

One of the most difficult manufacturing assignments given to General Motors was the making of supercharger rotator vanes. Cadillac designed special machines for the job, changed it from a hand-machining to a mass production operation and, in addition to a big saving in time, cut down on steel forging requirements to the extent of 496,000 lb. a year.

Engineers of AC Spark Plug Division asked why it wouldn't be more sensible to start with a thin plate and build up the thick end of a machine gun side plate by upsetting. Old method had been to start with a thick plate and shave half the thickness off except for a bump at one end. Army experts approved and the result has been a saving of 9 lb. of metal per gun.

Many divisions are saving high-grade tool steel by making tools out of low-grade steel except for the thin strip which forms the cutting edge. This strip is welded on. In one case, only 7/10 lb. of high vanadium steel now has to be used per tool instead of 10.3 lb., a saving of 93 percent of this highly critical material.

Buick engineers found that changing from steam hammer to upset forge would save 19 lb. of steel on each propeller shaft forging for Pratt & Whitney aircraft engines. By shifting from steam hammer to forging press they were able to save 7.08 lb. on each reduction fixed gear. Detroit Diesel Engine Division has developed a method of chemically treating engine pistons which makes tin plating unnecessary.



Aircraft Plant Adopts Capewell

On the hard-to-cut alloy steels used in aircraft construction, Capewell's Technite hack saw blades again set the pace for cutting faster, lasting longer. You, too, can accelerate production (and reduce blade expense) by specifying Capewell. Order through your mill supply man.

CAPEWELL

New PAGE ELECTRODE FOR ARMOR WELDING HELPS GET TANKS INTO ACTION!

A new electrode for welding armor was developed exclusively by **PAGE** *to cooperate with the change-over to welded tank production. It met all ballistic tests on plates submitted to the Army Ordnance Department by the tank manufacturers—and then went into action, having a real part in the great records that since have been set on welded tank production lines.*

It is worthwhile to note that, in spite of the pressure for speed, tank welders have been well schooled in technique that wastes no electrode—gets maximum strength with the use of no unnecessary metal in the weld—uses every electrode right down to the holder. All users of welding rod would do well to insist on their men observing such economy today.

PAGE WELDING ELECTRODES

PAGE STEEL AND WIRE DIVISION
Monessen, Pa., Atlanta, Chicago, New York, Pittsburgh, San Francisco

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

In Business for Your Safety

Photo by U. S. Army Signal Corps

When "down-time" makes you see RED

IF "DOWN-TIME" is slowing your production . . . shaving profits—look to your cutting oils. For every cutting oil operation is different. An oil may do a bang-up job in one operation and cause all kinds of trouble in another, due to variables in metals, speeds and depth of cut.

That's why Shell has developed a control technique that "balances" the oil for each particular job . . . fits the oil to the machine, the application and the tool. In addition, Shell Lata Oils are delivered to you ready for instant use, eliminating costly blending mistakes, insuring uniformity at all times.

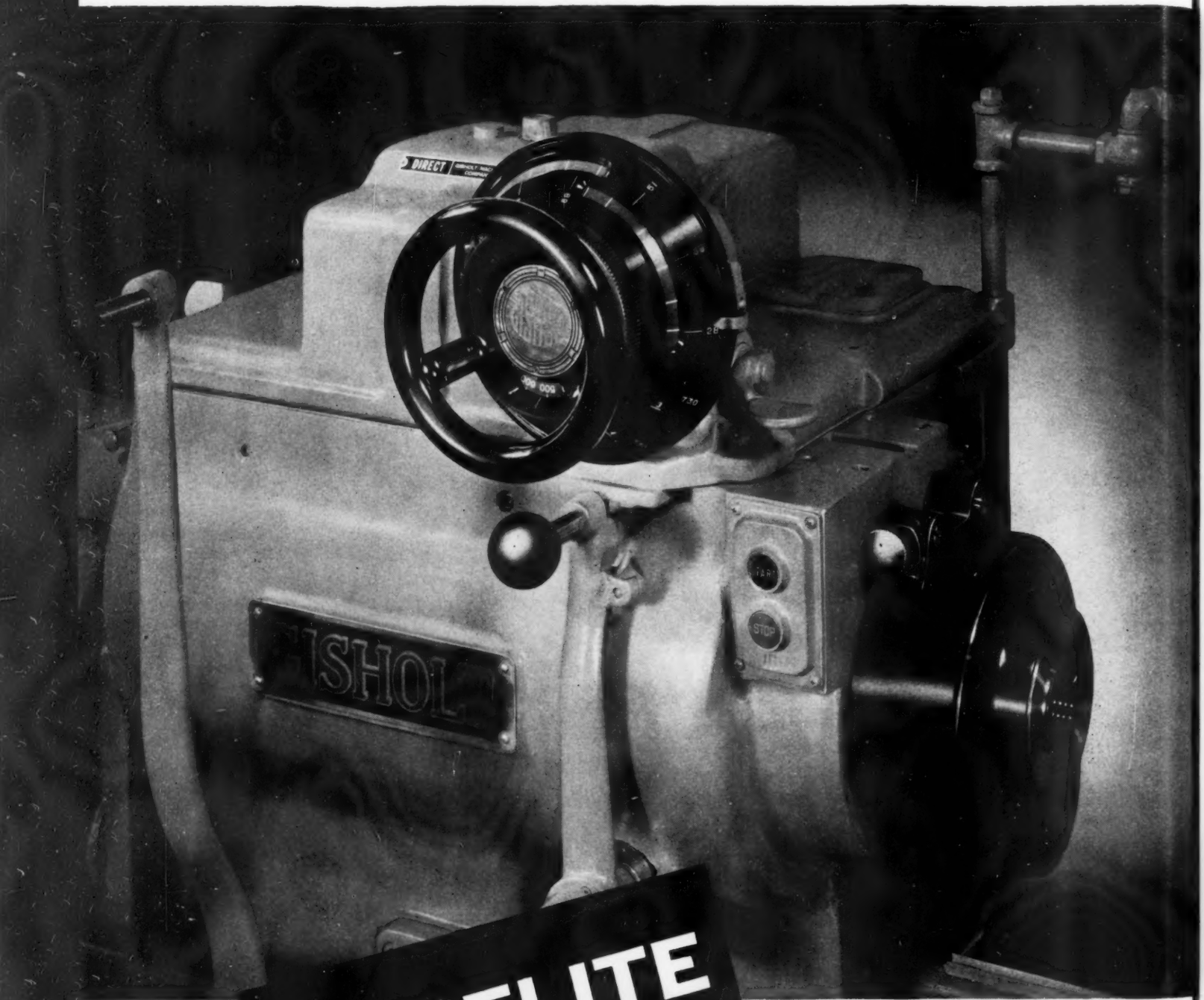
Call in the Shell man today. Let him show you how the right Shell Lata Oil can not only reduce "down-time," but how it can also improve surface finish, increase tool life.

OIL IS Ammunition -USE IT WISELY

SHELL

SHELL LATA OILS *for Cutting*

6 PLASTIC PLUSSES



BAKELITE

The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

PLASTICS HEADQUARTERS

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

3 WAYS Can Help You Speed

1. LITERATURE ON "DO'S" AND "DONT'S" OF PLASTICS... Helpful technical booklets containing data on types and forms of BAKELITE plastics, and the most efficient methods of fabrication. This literature will help you to choose the right plastic for each job, save time and avoid errors.

FOR HEAVY-DUTY MACHINE TOOL PARTS

IMPACT RESISTANCE... FAST PRODUCTION ...ARE TWO OF MANY ADVANTAGES GAINED BY GISHOLT

THE REDESIGN FOR PLASTICS PRODUCTION of speed-selector dials and chuck guard on the Gisholt lathe brought about numerous improvements typical of those often made when BAKELITE plastics supplant other materials. And, equally important, the use of plastics released strategic materials for other essential purposes.

First, and most important gain, is the fact that the parts, molded in a few minutes from BAKELITE plastics, are immediately ready to use. Time-consuming drilling, reaming, tapping, and enameling are completely by-passed.

The impact resistance of these parts is another important advantage. An engineer or designer whose information on plastics is not up-to-the-minute may not realize that there are now available BAKELITE molding materials with impact strength up to 2.7 ft-lb. energy to break (Izod). For the parts shown here, the material used has a flexural strength of 10,000 lb. per sq. in., and a tensile strength of approximately 8,000 lb. per sq. in.

But, BAKELITE plastics' advantages do not stop there. Consider also such advantages of weightsaving, dimensional stability, self-contained color, and others listed at the right, and you will realize the contribution that plastics can make to many essential industrial applications.

When You Write "PLASTICS" on a Blueprint

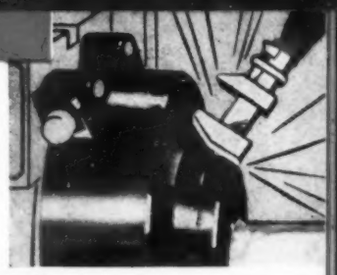
If, in your war production, there are places where BAKELITE plastics can replace strategic metals, or supply flexibility, durability, dimensional stability, and resistance to impact, moisture, or chemicals; by all means enlist the co-operation of our Engineering Staff and Development Laboratories. Make certain, when you write "plastics" on a blueprint, that you have selected the right materials and the correct fabricating techniques to save time and materials, and to avoid costly errors.

BAKELITE CORPORATION, 30 East 42nd St., New York, N.Y.
Unit of Union Carbide and Carbon Corporation

UCC

IMPACT RESISTANCE

This BAKELITE plastic chuck guard will withstand heavy impact blows. Yet its weight is only one-fourth that of its predecessor.

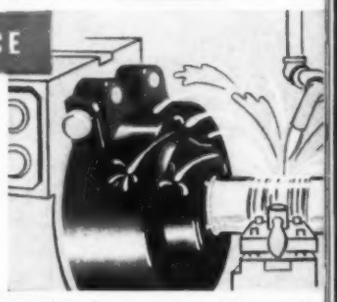


LIGHT WEIGHT

Light weight is an important advantage in this 12-in. handwheel. Had heavier material been used, it would have added momentum to the turn of the wheel, causing it to spin beyond the desired position.

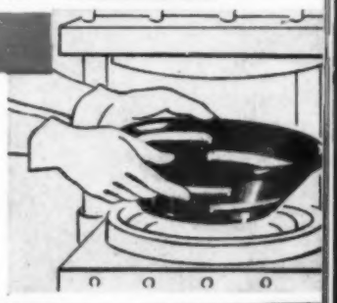
CHEMICAL RESISTANCE

These Gisholt parts are unaffected by cutting oils, greases, and alkalies. Constant handling will not mar the lustrous finish of the speed selector. Moisture will not corrode the parts.



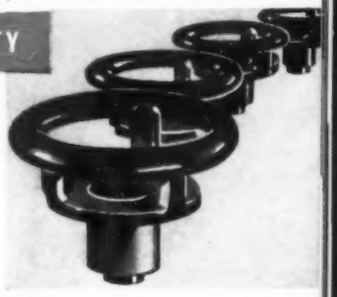
FAST PRODUCTION

Parts can speedily be molded from BAKELITE plastics usually in a few minutes. Generally, they are ready for use as removed from the mold, thereby avoiding drilling, reaming, tapping, enameling, and other finishing operations.



DIMENSIONAL STABILITY

The BAKELITE plastics employed for the Gisholt parts are noted for their dimensional stability. They, therefore, are adapted to mass production of parts which are interchangeable. Also, the accuracy of the fine calibrations will be maintained despite temperature changes, long term aging, or exposure to moisture and chemicals.



LEGIBILITY

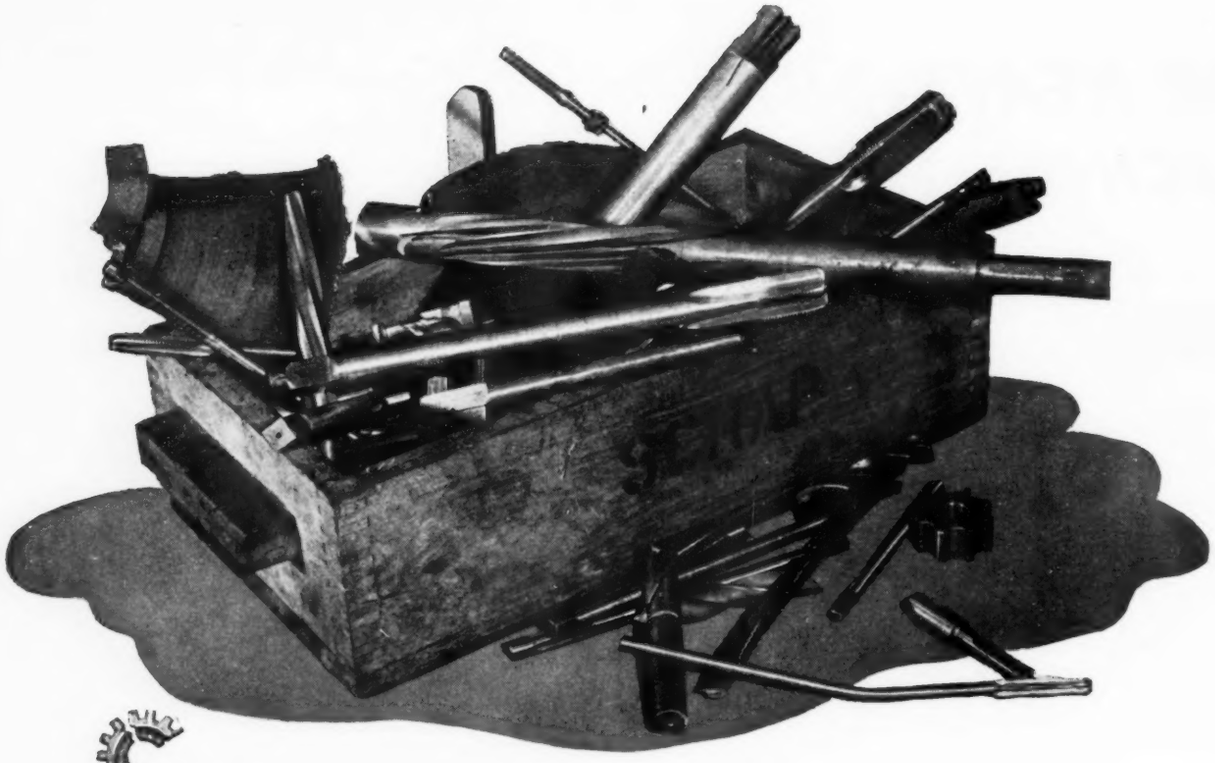
The legibility of markings on the speed selector has been improved two ways. First, the inner dial is molded in a bright red. The color is integral with the material and will not chip off or lose its brilliance. Second, the intaglio calibrations are formed in the molding process, and then filled in with white pigment insuring maximum legibility from any angle.

"BAKELITE" PLASTICS HEADQUARTERS Production and Conserve Strategic Materials

2. GEARING OUR LABORATORIES TO YOURS... Bakelite Laboratories offer a two-fold service. They are ready to help you utilize present plastics in war production. They will also develop new formulas to help solve the problems of highly specialized requirements.

3. FIELD WORK ON "FRONTLINE" JOBS... Located at important industrial centers throughout the nation, Bakelite Field Engineers are ready to give prompt service to manufacturers engaged in war production. Fully qualified, they can frequently solve production problems on the spot.

GET "HEADQUARTERS HELP" ON PROBLEMS RELATING TO PLASTIC MATERIALS, DESIGN, AND FABRICATING TECHNIQUES



SCRAP SALVAGE *is a* LAW *at* GREENFIELD . . .

SO ACUTE is America's metal shortage — particularly of high speed tool steel — that today the importance of scrap cannot be overemphasized.

Industry has a responsibility it cannot evade, not only to *reduce* scrap-making in plants, but to *salvage* it to the last ounce. Even the tungsten from filings and sludge must be recovered and turned back into productive channels.

The GREENFIELD TAP AND DIE CORPORATION has assured our Government that a rigid plan of salvaging is now in force in every department of its plants.

What "*Greenfield*" is doing, must be done by every factory and shop throughout the country. Failure to carry out a scrupulous system of salvaging can almost be viewed as actual sabotage!

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES

ARMY E NAVY

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
DETROIT PLANT: 5850 Second Boulevard
WAREHOUSES in New York, Chicago and Los Angeles
In Canada:
GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

"Your Drive-All transmissions have done everything you said they would do, giving us trouble-free operation and allowing us to take higher speeds and heavier feeds than were taken previously.

"A pleasant surprise to us has been the actual reduction in our power cost. With our old setup, we had only one large electric motor. Adding up the horse power of all the motors needed for your service drives, we found the horse-power almost three times as much and naturally expected the power bill to be higher.

"Evidently, the efficiency of the one large motor used in our old setup was greatly offset by the loses in the line shafting and extra bearings. As a result, our power costs are now approximately 20% less than they were before we changed to your drives."

FAMOUS MANUFACTURING COMPANY
East Chicago, Indiana
Martin Petersen, *Manager*

There are standard Drive-All selective speed motorizing units for application on all belt-driven machines. 1 to 10 H.P. in either 3- or 4-speed models. Can be mounted on an average machine in about two hours time. All models also available with clutch and with right or left hand output. Variety of standard mounting brackets save installation time and provide simple belt adjustments.

☐ LATHES AND TURRET LATHES

☐ MILLING MACHINES

☐ GEAR CUTTERS

☐ DRILL PRESSES AND RADIALS

☐ AUTOMATICS

☐ ☐ SHAPERS AND PLANERS

☐ TAPPERS

☐ BORING MILLS

☐ SPECIAL APPLICATIONS

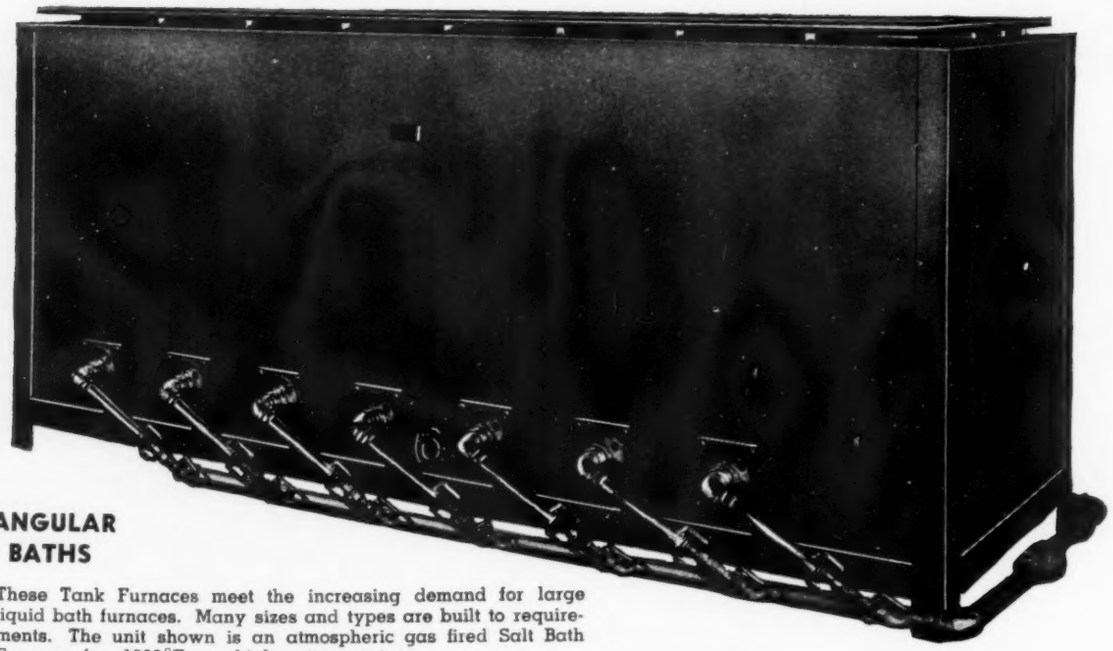
Write for New Catalog.

DRIVE-ALL MANUFACTURING COMPANY

3400 CONNER AVENUE — DETROIT, MICHIGAN

BUZZER

INDUSTRIAL GAS FURNACES



RECTANGULAR HEAT BATHS

These Tank Furnaces meet the increasing demand for large liquid bath furnaces. Many sizes and types are built to requirements. The unit shown is an atmospheric gas fired Salt Bath Furnace for 1000°F. or higher temperature.

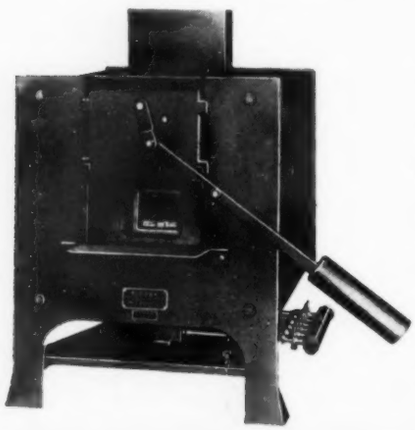
QUICK HEATING TO HIGH TEMPERATURES WITHOUT BLOWER

HIGH SPEED MUFFLE FURNACES

Shown below is a bench type BUZZER "Super Heat" High Speed Atmospheric Oven Furnace equipped with special BUZZER Venturi Nozzle Burners having a wide range of control. A temperature of 2400° F. is obtainable in 1½ hours in these furnaces without blower, power or auxiliary equipment of any kind. Has Diamond block for protection atmosphere.

Rugged, well insulated, these furnaces can be depended on for long life, high efficiency and economy. Made in several bench sizes.

Also large floor types.



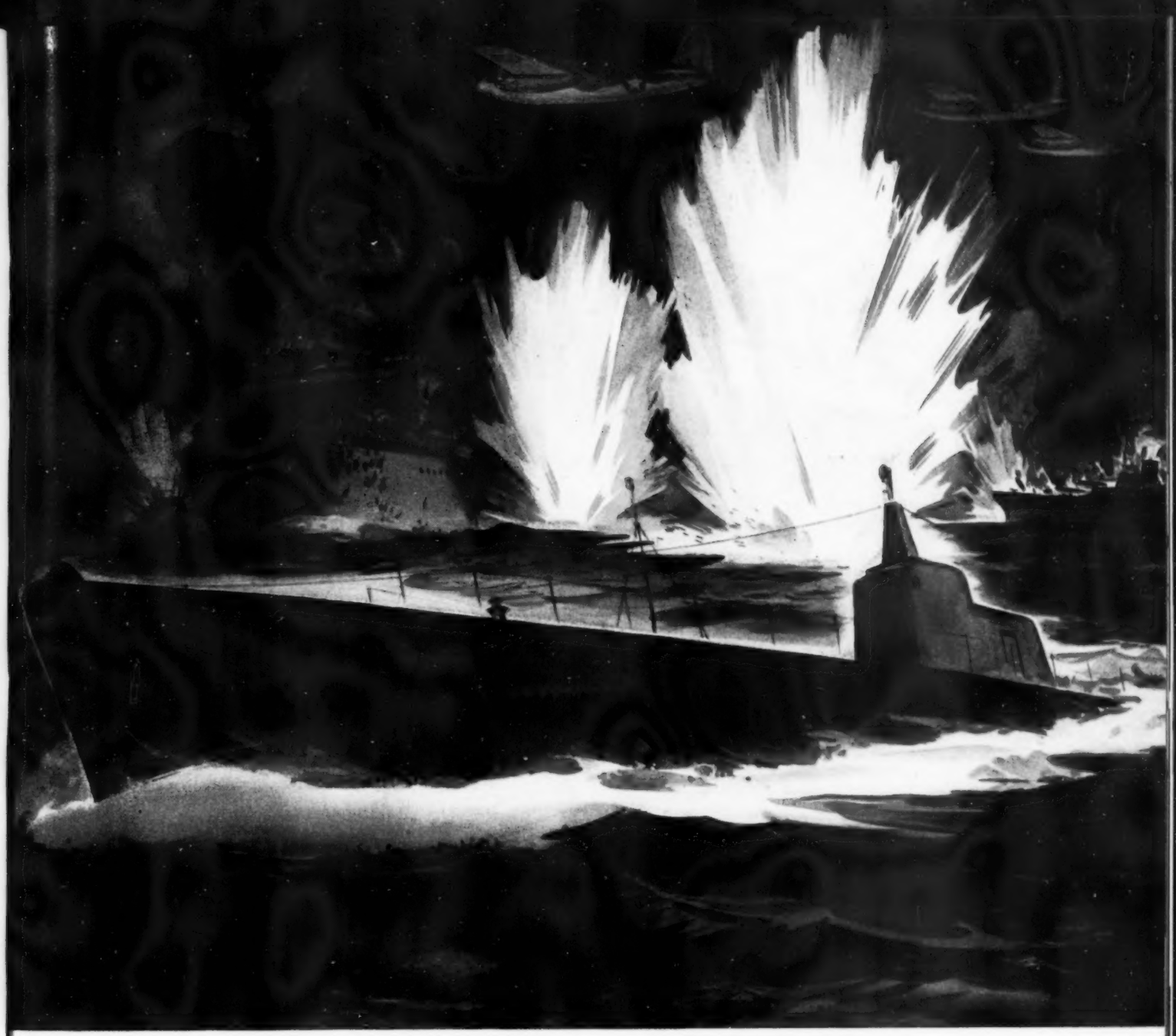
ATMOSPHERIC POT FURNACES

These BUZZER units (one of which is shown at right) are the latest in design for cyanide, salt bath and lead hardening. They are ready for operation by merely connecting to gas supply. A temperature of 1650° can be attained in one hour and fifteen minutes.

Features include tangential firing at top and venting at bottom so that even heating and longer pot life are assured. Several standard sizes are available.

Write for complete 32-page Catalog covering the complete "BUZZER" line.

CHARLES A. HONES INC., 121 So. Grand Ave., Baldwin, N. Y.



Scratch One Flat Top*

U. S. Submarines glide through the dark water. They range the enemy's seas, looking for one thing—a clear sight—the first sight at an Axis ship. Then, striking alone, or with the battleforce, or airforce, as at Midway, they fire their deadly missiles.

At VARD we are helping our Navy get that first accurate sight on the enemy ship.

We are working around the clock, making navigation instruments, aircraft parts and optical goods. VARD precision inspection gages are also produced for many plants manufacturing ordnance.

Our entire strength is devoted to the war effort. "We are working longer hours. We . . . realize that one extra plane or extra tank or extra gun or extra ship completed tomorrow may, in a few months, turn the tide on some distant battlefield; it may make the difference between life and death for some of our fighting men."**

*REPORT TO CARRIER, BY SQUADRON LEADER, LT. COM. ROBERT DIXON, IN U. S. NAVAL ACTION, CORAL SEA, MAY 7, 1942.

**FROM RADIO ADDRESS, BY PRESIDENT ROOSEVELT, AT WHITE HOUSE, FEBRUARY 23, 1942.

VARD INC.

PASADENA, CALIFORNIA, U. S. A.

Airco Apparatus Repair Stations are located in the cities shown above.

HAVE ITS LIFE RENEWED
AT AN AIRCO APPARATUS STATION

New oxyacetylene torches, tips and regulators are becoming more and more difficult to obtain every day. Therefore, it's imperative to make existing apparatus last as long as possible.

Worn or damaged Airco equipment should never be scrapped before it is examined at an Airco Apparatus Repair Station. In most cases it will be repairable—and returned to you, quickly, as good as new.

Avail yourself of Airco's national repair service — staffed by company trained and supervised men. Regardless of your location, there's an Airco Station in your area.

Air Reduction

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y.**

IN TEXAS

MAGNOLIA-AIRCO GAS PRODUCTS CO.

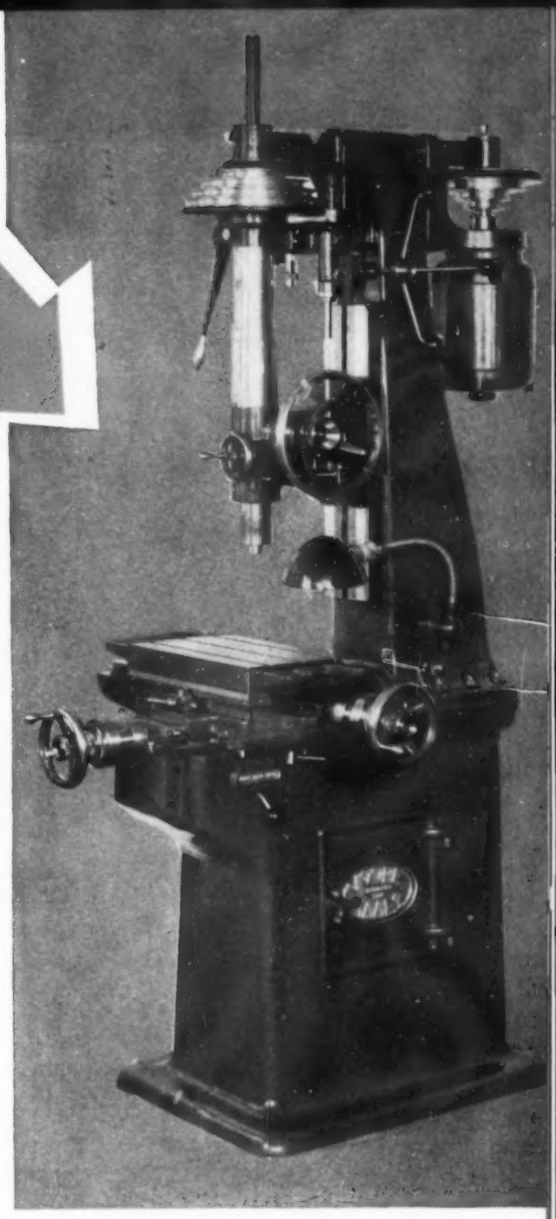
General Offices: **HOUSTON, TEXAS**

OFFICES IN ALL PRINCIPAL CITIES

AIRCO WILSON

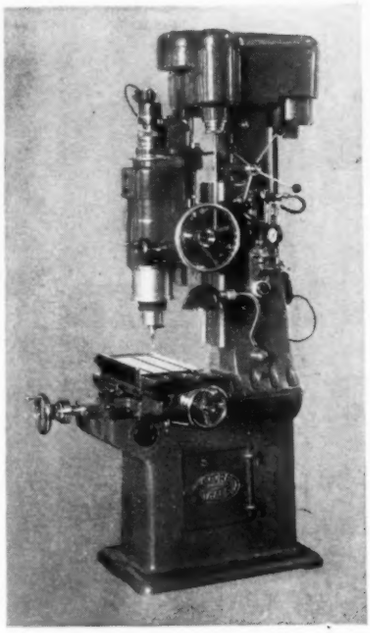
OXYGEN IS PRODUCTION — *Don't Waste it!*

MOORE JIG BORER and MOORE JIG GRINDER



COMPANION MACHINES

that go hand in hand in speeding precision tool and die work . . .



10 SPINDLE SPEEDS AVAILABLE FOR ANY JIG BORING JOB

Fast, accurate spotting, drilling, reaming, boring are handled on the Moore Jig Borer with maximum convenience and minimum effort.

This machine follows advanced and time-tested practice in the use of hardened, ground and lapped parts such as precision lead screws and quill. Spindle is supported on four pre-loaded ball bearings. Utmost accuracy and maintained precision so important to any jig borer are assured in Moore design and construction.

Ten spindle speeds are provided with a range from 100 to 2600 R.P.M. when driven by a two-speed motor. Spindle feed is provided in either direction by power or hand and is engaged with friction clutch.

INFINITE SPINDLE SPEEDS from 50 to 150 R.P.M. PROVIDED by the MOORE JIG GRINDER

This companion machine to the Moore Jig Borer will grind straight or tapered holes to size as well as correct location of holes in hardened steel parts. It has a grinding capacity from .030" to 4". It is indispensable as a means of saving time on die and tool work.

Condensed Specifications

Table Working Surface—10"x16"

Table travel longitudinal—14¼"

Table travel crosswise—9¼"

Table top to spindle end—Min. 3" Max. 16"

Vertical adjustment of quill housing—9"

Boring capacity — (with 2 speed motor) 3½" tool steel; 4" soft steel (with single speed motor) 2" tool steel 2½" soft steel.

Write for* COMPLETE DETAILS *on These Essential Tool Room Machines

Manufactured by

THE MOORE SPECIAL TOOL CO., Inc.

BRIDGEPORT, CONN.

Exclusive Representative

MARBURG BROS., INC., **90 West Street, NEW YORK CITY**

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

NOW- without priority!

ALLOY ELECTRODES FOR MAINTENANCE AND REPAIR

Of course, war production comes first! But America's machinery producing for civilian life must keep running, too! That's why the U. S. Government (through Limitations Order No. 146) makes it possible for you to secure, *without priority*, the welding electrodes necessary for maintenance and repair work.

Our fullest co-operation makes possible a limited percentage of our production of P&H Alloy Electrodes for this purpose. These include such indispensable electrodes as P&H "Harcote" for hard-surfacing to resist wear and give new life to many parts. Numerous other electrodes also are available to answer every need for resisting wear, abrasion, and impact; for welding stainless steels; 4-6% chrome steels, etc. The only restriction is that they must be used for maintenance and repair.

P&H FOR ALLOY ELECTRODES

HOW TO ORDER—

Write us; we will send you information on how to obtain P&H Alloy Electrodes; also data sheets on how to select and use them.

General Offices: 4514 W. National Avenue, Milwaukee, Wisconsin

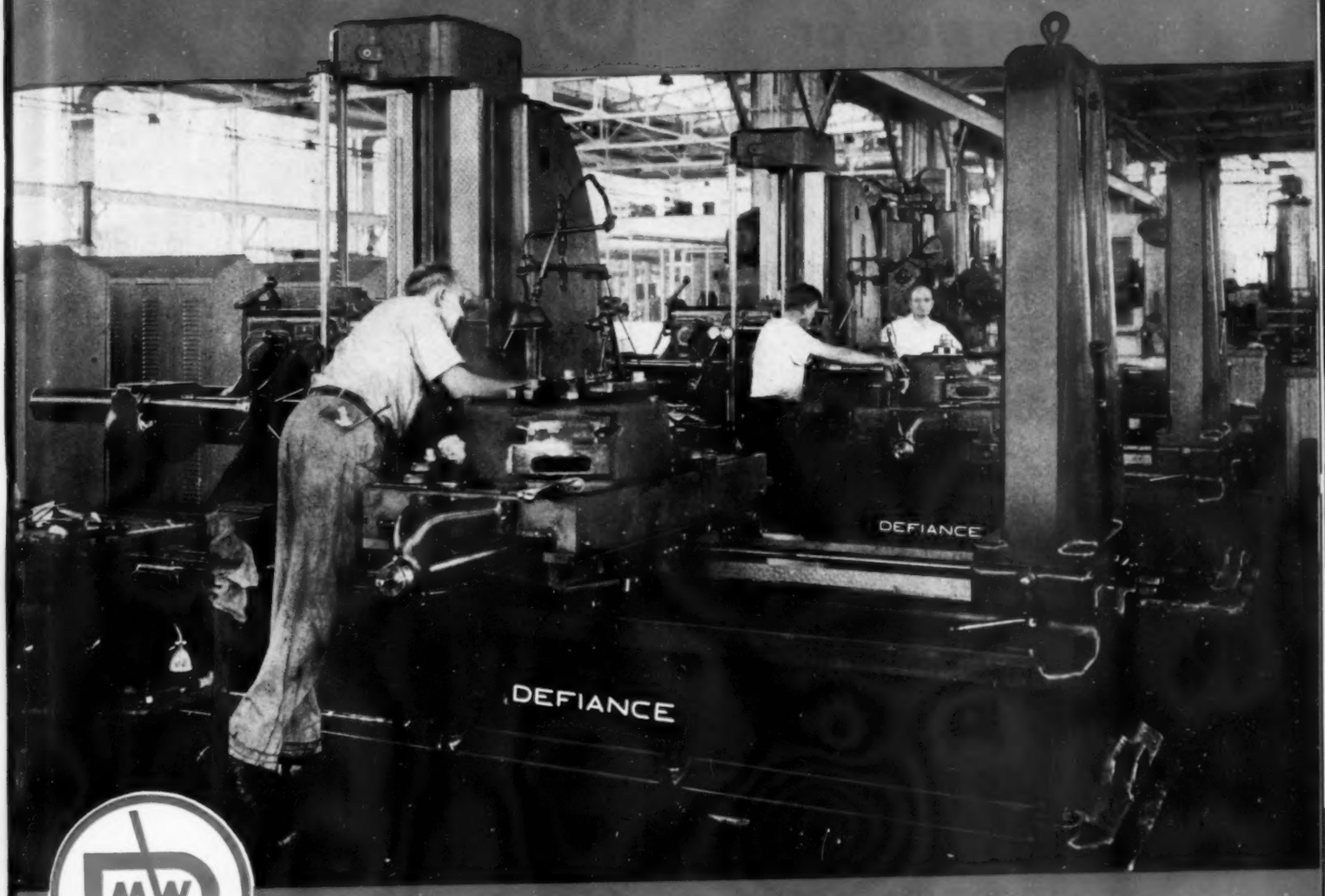
HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Company, Ltd.

Extreme Accuracy

IN PARTS FOR TANKS AND GUN MOUNTS



At great American plants that have turned to War Production, Defiance Machines are relied upon for their extreme accuracy. Here you see Defiance Machines producing parts for tanks and gun mounts.

Unusual rigidity and strength are designed and built into Defiance Mills . . . the only horizontal boring mill having outboard bearings, an integral part of the machine, thus eliminating worry as to accuracy of supports. Complete oversize construction insures outstanding ruggedness and precision . . . absorbs vibration!

Defiance performance meets today's urgent demands for *speed* and *accuracy* . . . with dependability that minimizes expensive down-time. See our insert in Sweet's Mechanical Catalog or send for latest bulletins.

Defiance Machine Works, Inc., Defiance, Ohio.

Makers of Precision Machinery Since 1850

Horizontal **BORING . . MILLING . . DRILLING . . TAPPING** *Machines*

DEFIANCE

MICRO-PLATE

(PATENT PENDING)

An Amazing New Service for War Industries

ENDORSED BY W. P. B.

Parts showing application of MICRO-PLATING and SPOT-PLATING

Micro-plating builds up worn or deficient areas *only*—with chromium or other metal. Thus, applying metal only where needed,

- . . . ***saves expense and scarce materials;***
- . . . ***prevents idle machine time, because it***
- . . . ***eliminates unnecessary re-machining;***
- . . . ***prolongs or renews life of expensive tools;***
- . . . ***reclaims defective new parts;***
- . . . ***salvages old, worn parts. Has innumerable uses.***

Applicable to the smallest parts as well as to large surfaces, internal or external, in thicknesses from .00001 upward.

A telegram, phone call or letter will immediately bring you descriptive folder and full information.

INDUSTRIAL CHROMIUM CORP.

Micro-Plate Dept. 10

HOLYOKE - - - MASSACHUSETTS

Prevents overheating, scoring, softening of **dead centers.** Saves the center and the work. A many-use **anti-seize** lubricant of amazing film strength. Withstands severest pressures.

Quick, convenient to use from 1, 4, and 8 ounce collapsible tubes. See your supply house, show them this advertisement. If not yet stocked by them, cut out, fill in and mail this form directly to us, and we will ask your supply house to stock it for you and their user trade.

JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.
I am interested in trying DIXON'S LATHE CENTER GRAPHITE LUBRICANT.
My Supply Houses are:

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Name.....

Address.....

JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.

Ticonderoga Graphite • No. 635 Graphite • Microfyne Graphite • Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite).

Meet the urgent need to produce MORE with LESS with the "Know-How" of the

Disston Conservation Control Cards contain such data as Typical Troubles and Failure to Achieve Proper Performance; Cause of the Trouble; Correction; and Recommendations for Various Materials to be Cut.

DISSTON CONSERVATION CONTROL PLAN

CONSERVATION • SERVES EVERYONE •

THE basic principle of good manufacturing practice is getting the very most out of what you have to work with . . . time, tools and materials. Using the best equipment obtainable and keeping it working at maximum efficiency are vital duties today.

The Disston Conservation Control Plan has been devised to meet these urgent wartime demands. The fundamental purpose of the Plan is to help industries turn out *more* and better products—with *less* lost time, *less* tool breakage, *less* waste of essential supplies.

The "Know-How" to do this is contained in Disston Conservation Control Instruction Cards—providing specific information on the most efficient use and care of 34 different types of cutting tools. Many of the nation's leading manufacturers report these cards exceptionally effective in saving tools—in simplifying and multiplying supervision—in speeding training—in making the most productive use of time, effort and equipment.

Nearly three-quarters of a million Conservation Control Cards are in service throughout American industry. They are available to *you* without cost or obligation. For complete information write today to Henry Disston & Sons, Inc., 1020 Tacony, Philadelphia, Pa., U.S.A.

GET YOUR SCRAP INTO THE SCRAP!

THIS FREE BOOKLET contains reproductions of the Disston Conservation Control Cards, a convenient order blank and a description of the Disston Plan. Send for it *now!*

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E
NAVY
Awarded to OTC Employees by the U.S. Navy . . . for "Excellence in Production"
In winning this award, the nation's highest industrial tribute, OTC employees have proved that even a small organization can make an important contribution to the War Effort. We consider this official recognition not as a final goal, but as a challenge to greater effort, greater sacrifice, greater production. We will continue to strive for new records until Victory is achieved.
"We have just begun to fight"
With the "E" pennant over our heads, and the "E" emblem on our coat lapels, we will carry on with renewed vigor in the great task before us.
OWATONNA TOOL COMPANY
OWATONNA, MINNESOTA
OTC
for Industrial, Marine and Tractor Maintenance
TOOLS

"THE AVIATION INDUSTRY HAS WAITED
25 YEARS FOR THIS DRILL!"

CLECO

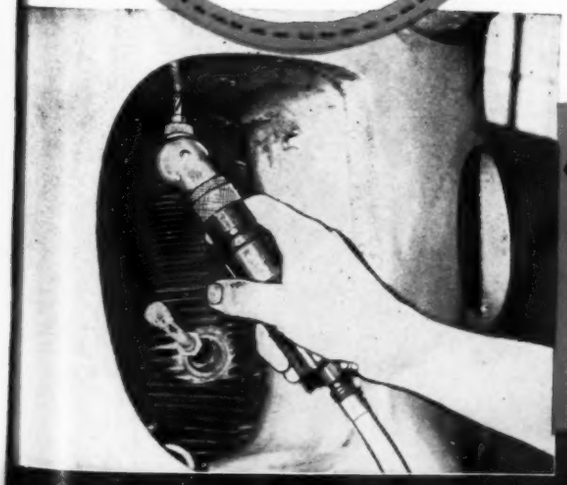
MODEL 9D020 DRILL

has these exclusive features:

1. The 9D020 drills at any angle and in any plane—at all 360 degrees of the circle.
2. The 9D020 needs only 1 5/8" clearance, is easily operated in restricted spaces.
3. Makes straight drilling easier, because fingers can be held close to point of application.
4. Eliminates the use of 30°, 45°, 60° angle drills —one drill does the work of many.
5. Double swivel permits adjustment at two joints, insuring complete flexibility.

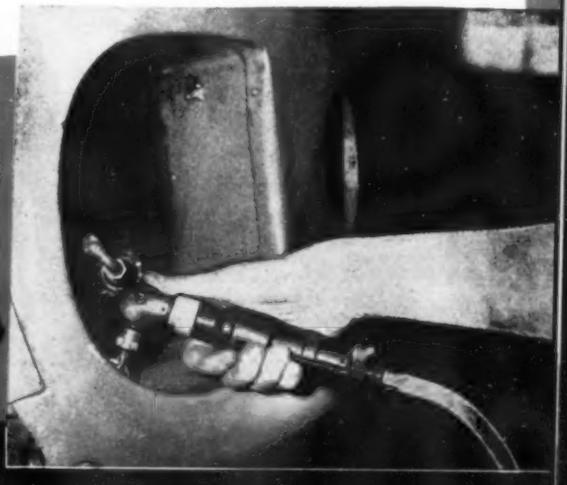
THIS DRILL WILL REALLY SPEED YOUR PRODUCTION

WRITE NOW FOR COMPLETE INFORMATION



Note how readily this drill can be used in hard-to-get-at spots.

Thumb placed close to point of application insures steady, accurate drilling.



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MARBLE AVE. & EAST 77TH ST. ★ CLEVELAND, OHIO

Time The Operations
Compare The Results

and you'll see why more and more war industries are using

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REG. U. S. PAT. OFF.

"The Soft Rubber Binder Cushions the Abrasive"

Smoothing and de-burring dural and stainless steel welded part with Brightboy Wheel.

Cleaning and smoothing threads with Brightboy Hand Tablet.

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Brightboy's unique and effective action is neither a grind nor a buff. It is the in-between, "ideal" finish that production men have hoped for—now achieved by Brightboy. Unsurpassed for close tolerance finishing. The wheels de-burr, polish and put on a slight radius all in one operation. Special shapes have innumerable applications in manual work and drill press jobs. Available to war industries only—through recognized mill supply distributors. Brightboy field men are at your service. Write for catalogs and prices if your distributor cannot supply you.

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WELDON ROBERTS RUBBER CO. **NEWARK, N. J., U. S. A.**

1. **NO "TIME OUT" CHANGES IN METHODS—**
   Brightboy is used in the conventional manner.
2. **NO SPECIAL TRAINING NECESSARY.**
3. **NO SPECIAL PREPARATION—**
   Ready for *immediate* use.
4. **NO WASTE—**
   Every bit is usable.

Wherever metal-working is in full swing, there you'll find

THE NATIONAL STANDARD FOR **WAR PRODUCTION**

IF IT'S A JACOBS★★★—IT HOLDS!

THE JACOBS MANUFACTURING COMPANY, HARTFORD, CONN.

HANDLE PRECISION MEASURING *and* CHECKING *of* GAGES WORK *and* PARTS

with the

SCHERR COMPARITOL

Convenient, Fast, Accurate, Versatile

All uncertainties due to the human factor are eliminated in measuring and checking with the SCHERR COMPARITOL. Any inspector, regardless of experience, will get the same reading every time on a given piece of work. Skilled operators are not required.

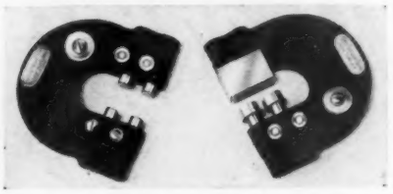
The COMPARITOL is ideal for precision inspection of plug gages, cylindrical ground work, screw machine parts and other work. Its utility is greatly extended by the use of attachments which are available. This SCHERR instrument provides Visual readings on a scale graduated to .0001, range is .004" plus and minus. It is made in two sizes: Standard measuring from 0 to 6" $195.00 Heavy Duty measuring from 0 to 8" $250.00.

THESE ATTACHMENTS EXTEND ITS UTILITY

- Measuring Head only for building into fixtures for special measuring applications.
- Ground and lapped flat table (4"x4") to accommodate heavy plug gages and large work.
- Hardened and ground V-blocks in various sizes for detecting out of round.
- Back stops for attachment to table for fast production checking.
- Feeler points with hardened steel balls, tungsten carbide, diamond and sapphire tips.
- Anvils of various lengths and widths, with or without serrations for special types of work.
- Ball anvil for measuring very thin work such as quartz crystals, laminations, etc.

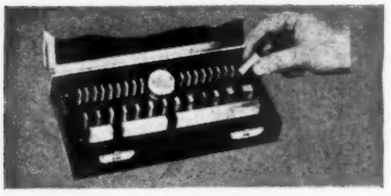
Investigate the possibilities of the SCHERR COMPARITOL as a means of solving your inspection and checking problems. ***Write for folder today.***

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY

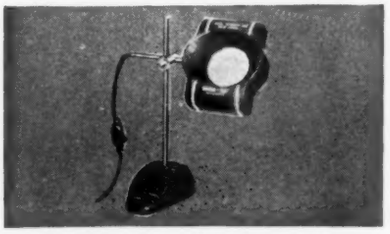


ATLANTIC ADJUSTABLE LIMIT SNAP GAGES provide accurate checkup without having to depend on operator's skill. Sizes to 6".

WILDER PROJECTOR provides accurate measuring or comparison of objects by means of magnified shadow.



ULTRA-CHEX—a 34 block set accurate to .000008", provides a basic standard of measurements.



MAGNI - RAY a wide-field illuminated magnifier providing a means for close inspection of work and operations.

SPENCER BINOCULAR MICROSCOPE—providing 3-dimensional vision for detecting surface finish, imperfections, etc. not possible to see with one plane of vision.

GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

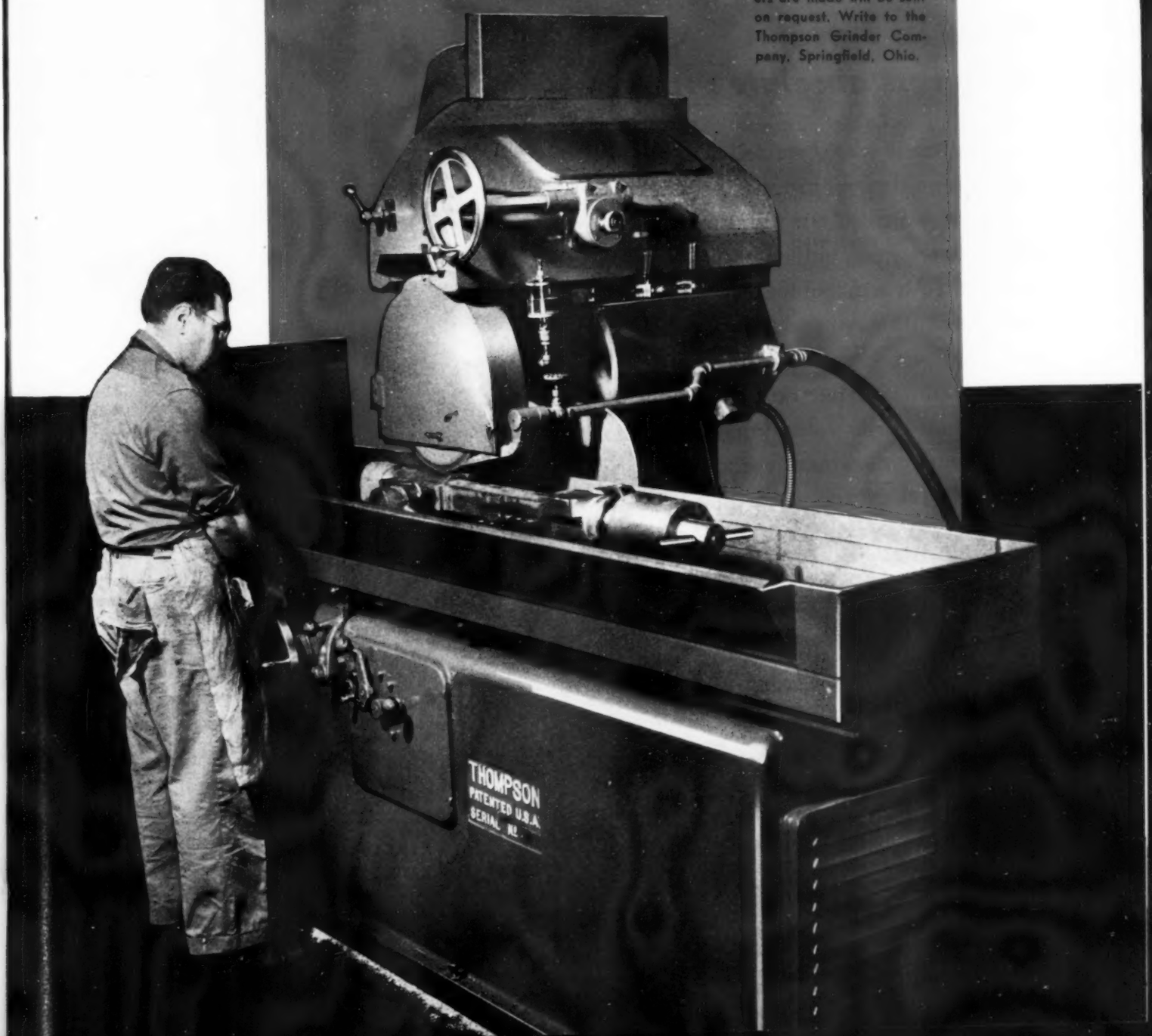
PRECISION GUN PARTS

. . . Ground with Mass-Production Efficiency on

THOMPSON GRINDERS

Calling for tolerances under .0001", precision parts for Anti-Aircraft Machine Guns are being ground at mass production speeds on Thompson Grinders. In the plant where the photograph below was taken, Thompson Grinders are responsible for the production of accurate flat surfaces on several vital components of these guns. Chosen for their extreme accuracy (and the ruggedness that helps to maintain it), for their easy set-up and high operating speeds, Thompson Grinders are doing their part to increase gun, tank, aircraft and munitions production.

Details and complete specifications of the wide range of sizes and types in which Thompson Grinders are made will be sent on request. Write to the Thompson Grinder Company, Springfield, Ohio.



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ALL-OUT PRODUCTION OF

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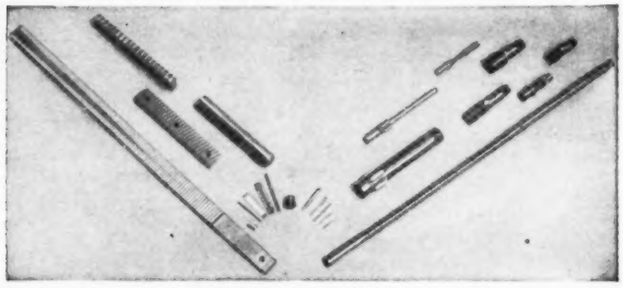
TO FILL WAR ORDERS
TO SPEED OUTPUT

Dalzen Thread Grinder No. 1 Grinds threads up to 10 inches in length any place on 18-inch shaft. Operating floor space 38 x 60 inches.

• *Dalzen Thread Grinders mean fast absolute precision*

It's significant when we tell you we're producing Dalzens straight around the clock every day —but we've *tripled* our plant to take care of the big demand from industries working on Army, Navy and Air war equipment! That proves that Dalzens can be depended upon for speed plus high precision in grinding threads 4" and 10" in length, right and left hand, in U. S. Standard, modified and British standard and special forms. Their compactness and vertical design insures constant equilibrium. And they



Shown above are some of the broaches and taps manufactured by Dalzen. The broaches are made in rounds, flats or form. The taps are Whitworth and British Association form.

Do Much More—Take Less Floor

Dalzens give you a wide range of compact, greater accuracy and increased production in far less space than formerly required. Send for special descriptive Bulletins. We also manufacture Taps, Broaches, and the Dalzen Combination Center Lapping Machine and Drill Press.

DALZEN TOOL & MFG. CO.
12255 E. 8 Mile Road — Detroit, Mich.

HOW AND WHY

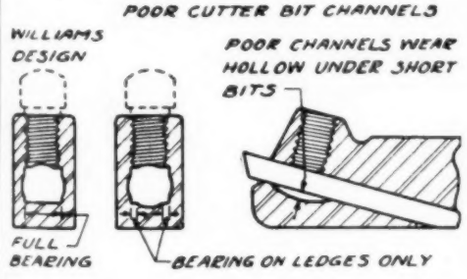
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

DATA ON WILLIAMS' TURNING-TOOLS

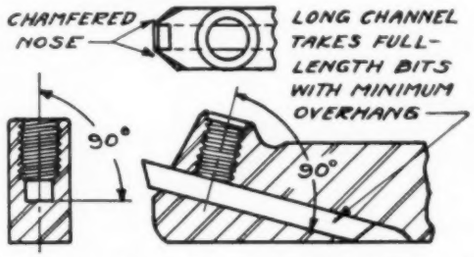
Since metal turning constitutes a major operation in our war production program, consideration of available tools for this purpose is timely. The Tool Holder system offers definite advantages over solid, forged tools for lathe, planer, shaper, etc. Greater convenience, efficiency and economy result with the use of properly designed Tool Holders, which save practically all waste of costly high speed steel, eliminate all dead stock of heavy forged tools, do away with all blacksmith labor and much grinding, and reduce lost man and machine hours waiting for tools substantially to zero.

Tool Holders, however, to satisfactorily replace solid forged tools, must be engineered to withstand the severe treatment which modern metal turning imposes on the cutting tool. Williams' Holders are drop-forged from a specially selected grade of steel, treated and hardened to develop maximum resistance to all wear and insure a hard rigid seat for the cutter directly under the holding or locking device. This tends to prevent cutter breakage which is due largely to the recess or pocket formed by short bits being forced into the cutter seat of the holder when the shank has not been properly hardened.



The bottom face of the shank of all Williams' Holders is rechecked after heat treating to insure a flat, square surface for the holder to rest on.

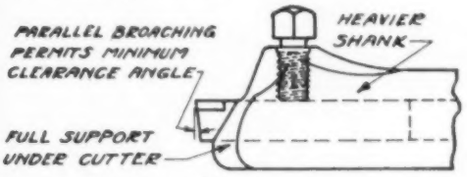
In Williams' Turning Tool Holders the nose is chamfered to permit convenient use in close quarters where space is limited. Set Screws are located at exact right angles to the cutter bit channel to provide full contact of the point of the screw with the cutter bit and insure maximum holding power. Screws and tapped holes are held to the close fits essential for long life under gruelling tool holder service.



Sketches above illustrate a straight shank Williams' Turning Tool Holder. Note that the extremely long cutter bit channel extends thru the bottom face of the shank, providing maximum entry for the cutter bit. This feature assures minimum overhang when a *full-length* bit is used, thus reducing the danger of cutter bit breakage.

Carbide Turning-Tool Holders

Since tungsten carbide cutters approach a diamond in hardness (88-92 Rockwell A), the brittle nature of this material makes it absolutely essential that the cutter bit be held rigid and the cutting edge supported as much as possible.



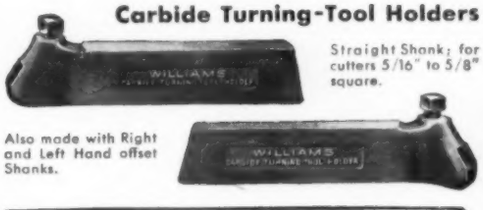
To provide a rigid tool and assure maximum support of the cutter, the shanks of Williams' Carbide Holders are made heavier and longer than regular Turning-Tool Holders of equal cutter capacity. The cutter channel is broached parallel with the base of the shank rather than at the usual 15° angle. The parallel broaching of the cutter slot permits proper grinding of the cutter so as to give maximum support to the cutting edge.

Regular Turning-Tool Holders

Straight Shank; for cutters 3/16" to 3/4" square.

Also made with Right and Left Hand offset Shanks.

Carbide Turning-Tool Holders

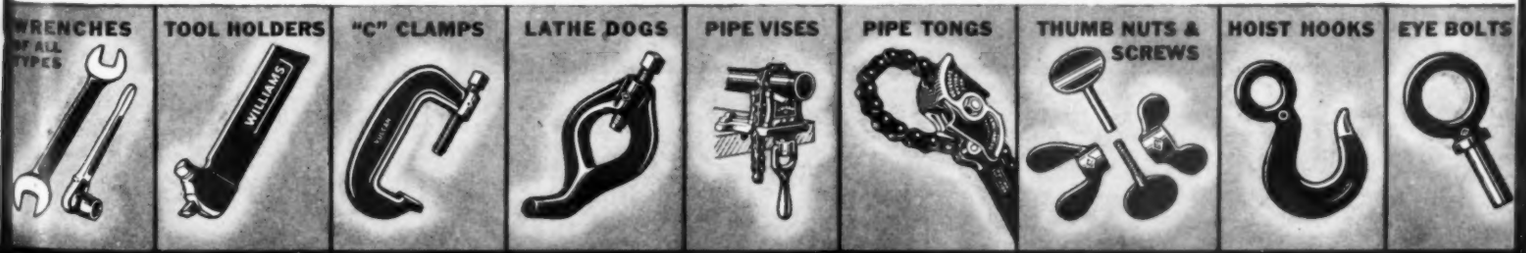


Straight Shank; for cutters 5/16" to 5/8" square.

Also made with Right and Left Hand offset Shanks.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere



MACKLIN GRINDING WHEELS

In these times of all-out war production it is frequently necessary to make complete change overs in grinding operations and methods to produce War Materials . . . Although there is a Macklin Grinding Wheel for every grinding job much time and trouble is often saved by calling for the specialized services of a Macklin Field Engineer . . . Out of wide experience he can recommend the proper wheel for the particular job.

DON'T TAKE BONDAGE — INVEST IN BONDS

CONVERSION:

. . . . from delivery trucks to tanks . . . . from autos to bombers . . . . from stoves to armor plate . . from yachts to sub-chasers . . from bumpers to bombs . . .

. . . . All need high-quality Macklin Grinding Wheels.

MACKLIN COMPANY

Manufacturer of Grinding Wheels

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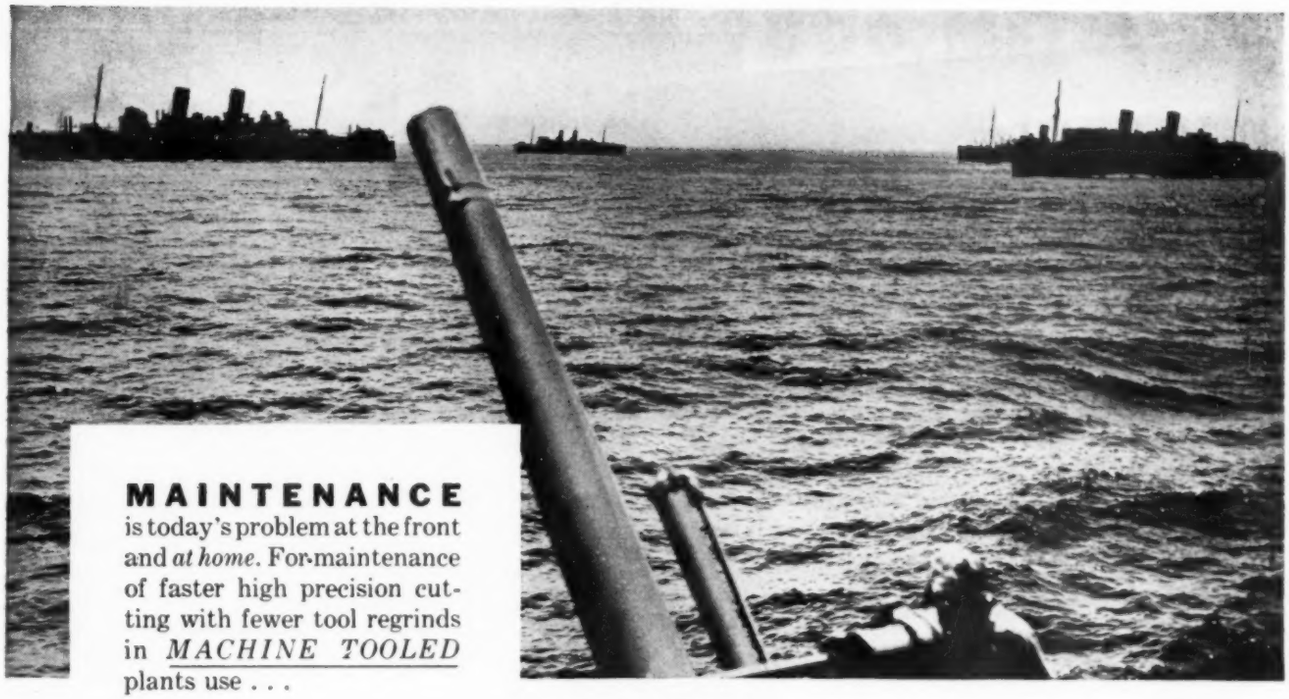
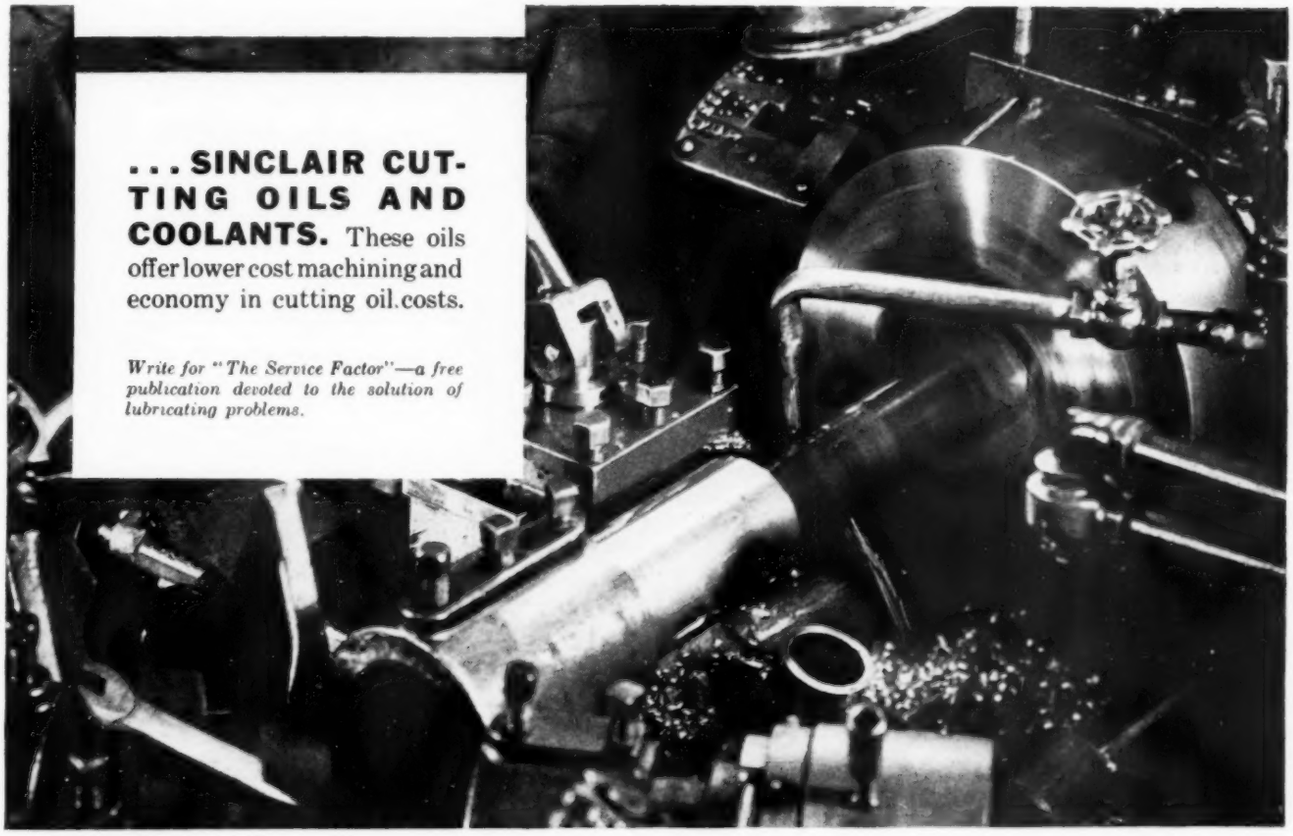


MAINTENANCE is today's problem at the front and *at home*. For maintenance of faster high precision cutting with fewer tool regrinds in *MACHINE TOOLED* plants use . . .



. . . SINCLAIR CUTTING OILS AND COOLANTS. These oils offer lower cost machining and economy in cutting oil costs.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

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FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

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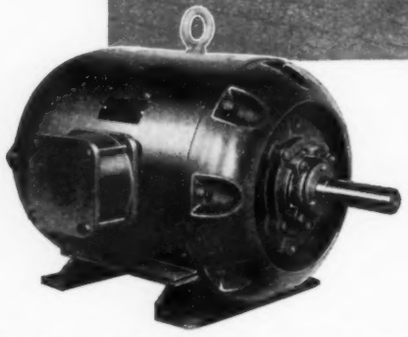
Let Wagner fill this spot... for highest Machine Tool efficiency!

Machine tool efficiency is of vital importance in the present speed-up of production. Motor failure with attendant delay and expensive "out-time" cannot be tolerated in this national emergency.

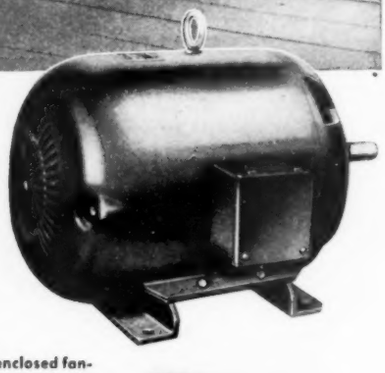
Your best protection against production delay and unnecessary expense is to use Wagner Motors on all machine tools and other electrically driven equipment. Their long life and absolute dependability make them well-suited for the job.

Wagner motors, the first choice during peacetime, can be depended upon to do "double-time" during this crisis. They are available in a variety of electrical types and sizes to take care of all kinds of machine tools. A few of the many Wagner motors are illustrated below. For information on the complete line write for bulletins MU-182 and MU-183, or consult the nearest Wagner branch office. Wagner branches are conveniently located in 25 principal cities. Wagner field-engineers will be glad to help you.

Type RP Squirrel-Cage motors are used on machine tools and other electrically driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycles, 2- or 3-phase.



Type HP motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125-hp, 2- or 3-phase, 25 to 60 cycles.



Type CP totally-enclosed fan-cooled motors are widely used on machine tools where dust, dirt, filings, chips, fumes or other destructive elements are prevalent. 1-1/2 to 125-hp, 25 to 60 cycles, 2- or 3-phase.

Send for copies of **BULLETINS MU-182 and MU-183**

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

SALES & SERVICE BRANCHES IN TWENTY-FIVE PRINCIPAL CITIES ★

M42-16

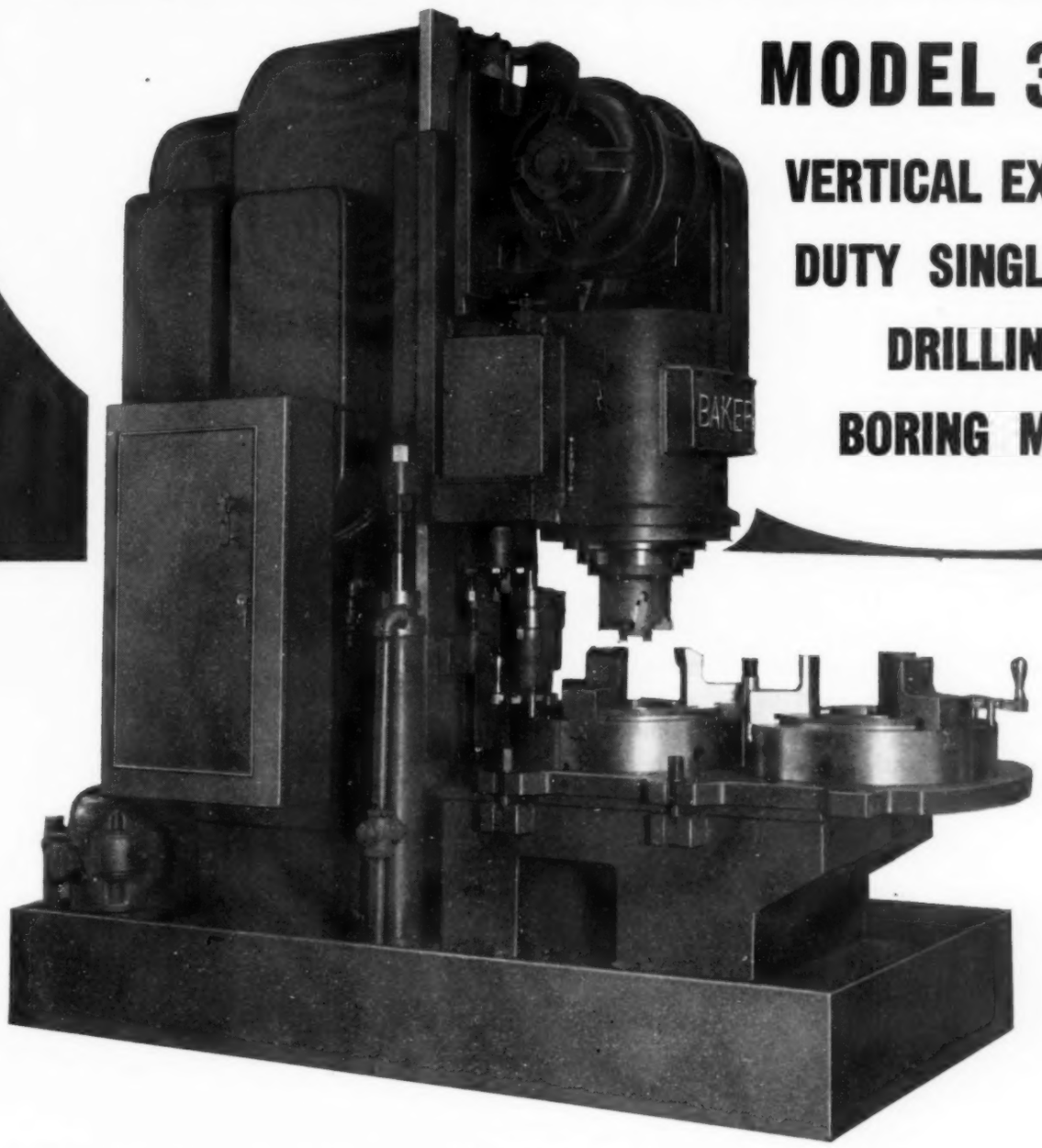
MOTORS · TRANSFORMERS · FANS · BRAKES

...HANDLES THE BIG JOBS FASTER...

BAKER

MODEL 30-HO-4

VERTICAL EXTRA HEAVY DUTY SINGLE SPINDLE DRILLING AND BORING MACHINES



Regardless of the type or size of job, *the need* is for *speed* in war production—and speed's what you get on the BIG JOBS with this BAKER MODEL 30-HO-4 Drilling and Boring Unit. Specially adapted to heavy sweep facing operations, the 30-HO-4 does an equally efficient job on all heavy duty drilling and boring operations. Its powerful, smooth drive, heavy duty construction and flexibility of spindle speeds provide more than adequate performance for your toughest jobs . . . helps to turn them out in a minimum of time, and at first-rate tolerances. Here, then, is a machine which represents a sound investment for today's war work, as well as tomorrow's peacetime operations. Write, wire or phone for complete details, descriptive folders, engineering data sheets . . . also information on deliveries.

CAPACITY . . . maximum feed pressure available, 18,500 lbs. . . . maximum H.P. for Head Drive, 30 H.P.

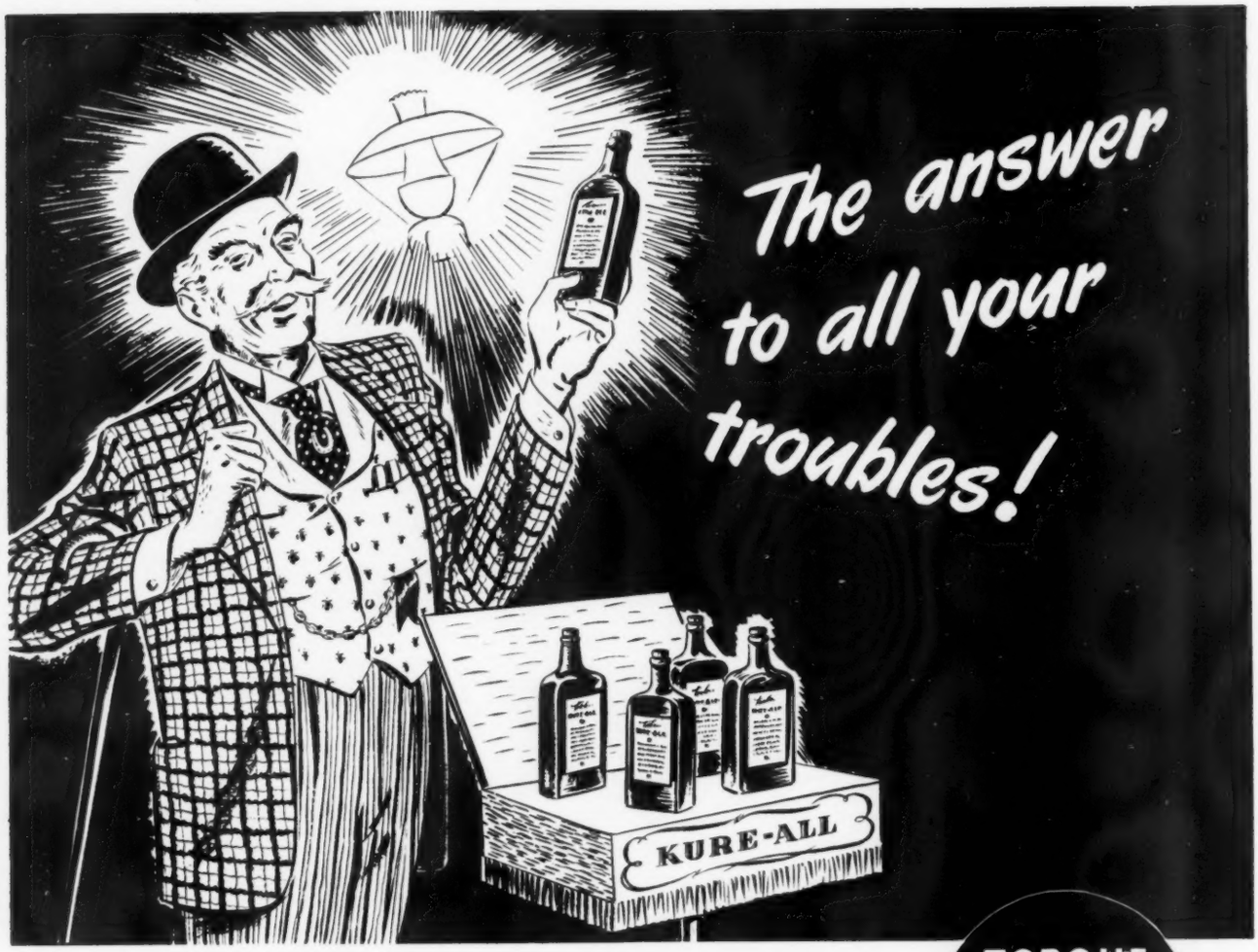
DESIGN and CONSTRUCTION . . . Vertical Frame, well ribbed with closed front face, BAKER Twin Pull cylinder mounting.

DRIVE . . . smooth, even, powerful . . . spindle driven by enveloping cone-type worm and worm gear. Pick-off gears in combination with sliding gear in head give two changes of speed, four with two-speed motor.

OUR MOTTO SINCE 1867 "MACHINES: STURDY and EFFICIENT, AS FINE AS CAN BE BUILT . . ."

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

DRILLING • BORING • TAPPING AND KEYSEATING MACHINES

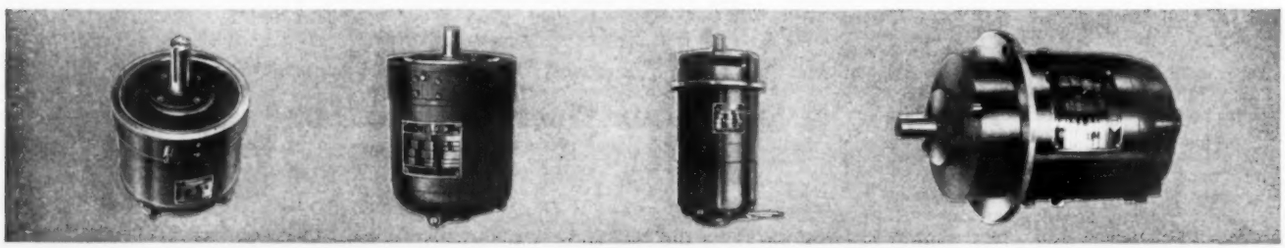


TORQUE
WELCO
MOTORS

● Backache, tonsilitis, or housemaid's knee—the stuff in the medicine man's bottle was supposed to be the cure for whatever ailed you.

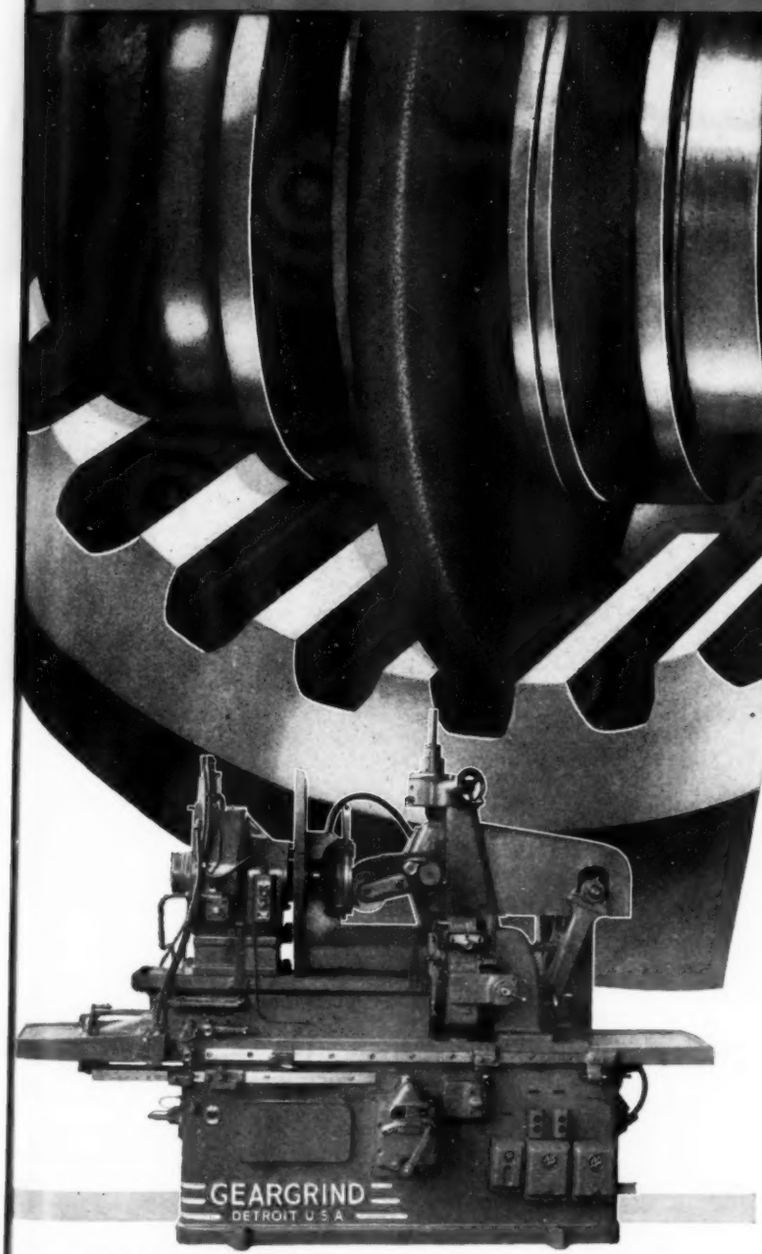
It would surely simplify your power problems if somebody could make *one* motor that would be the answer to every power question. Then, too, the study, work and worry of our prescription motor business could be eliminated.

As of today, there is still no substitute for diagnostic skill, a blueprinted prescription, and the engineering skill it takes to build a specific motor for a specific job. WELCO Torque Motors are the result of this, as yet, unbeaten combination.



The B. A. WESCHE ELECTRIC CO., 1626 Vine St., Cincinnati, Ohio

FORMED WHEEL
Internal Spline Grinding



GEARGRIND Internal Gear and Spline Grinder, Type GG-30

GEARGRIND Internal Spline Grinding Machines are manufactured in standard and special types. They are setting new standards of performance in producing internal splines with involute keys.

The type illustrated grinds splines, or gears, with internal diameters of from 3½" to 16" and up to 200 teeth. It maintains the following tolerances: Key or tooth thickness, within .0002; key or tooth spacing error, within .0004, maximum; root diameter, within .0002.

GEARGRIND Machines are available for all types of formed wheel grinding—external and internal gears, external and internal involute splines, straight splines, serrations and racks. Our standard machines cover a wide range, but special machines to meet your individual requirements can be produced. Your letter will receive prompt attention.

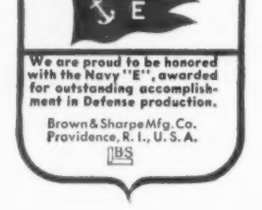
The GEAR GRINDING MACHINE COMPANY
DETROIT MICH. U.S.A.

. . . THE MORE HIGH SPEED STEEL SCRAP THE BETTER DELIVERIES YOU'LL GET ON CUTTER ORDERS!!

YOU CAN HELP by sending to the steel maker at once EVERY worn-out or broken high speed steel cutter in your plant.

The High Speed Steel situation is serious. Steel makers need much more High Speed Steel scrap than they are getting . . . if manufacturers are to be supplied with the required amount of steel of specified analysis for making new cutters.

Ship every pound of High Speed Steel in your plant in the form of worn-out or broken cutters back to the steel maker promptly. And watch out that this valuable scrap doesn't get mixed with your ordinary steel scrap . . . . prevent it from becoming lost for use in new cutters so critically needed today on production for the united war effort.


E
We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

BROWN & SHARPE CUTTERS

Yes indeed---

Our Engineers will gladly help you pick the *BEST DRIVE* for your purpose.

Horizontal and a Vertical Philadelphia Worm Gear Reducer installed outdoors at a large glue works.

For years, we have specialized in making *all types of speed reducing units* for use in practically every line of industry. As a result, our engineering staff has an answer, based on this experience, for most all power transmission problems. This broad understanding which can be applied to your situation may point the way to efficient, trouble-free power transmission.

While Philadelphia Units are made to a standard, they are, in fact, custom built to meet the job. Write now and tell us your problems.

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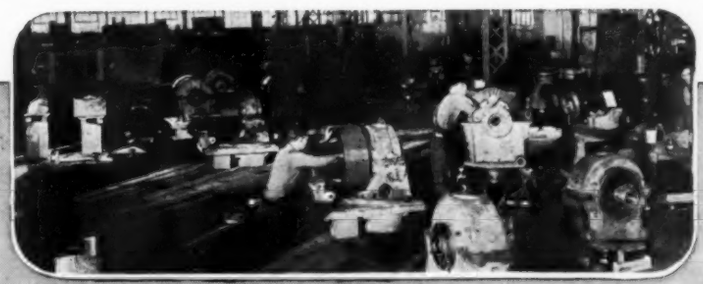
INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago



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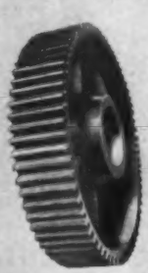
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.



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right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

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The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

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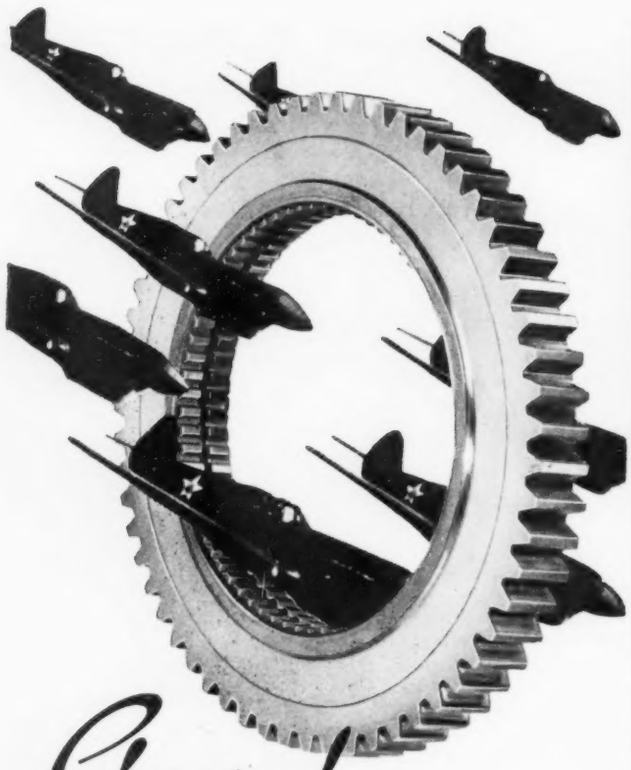
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



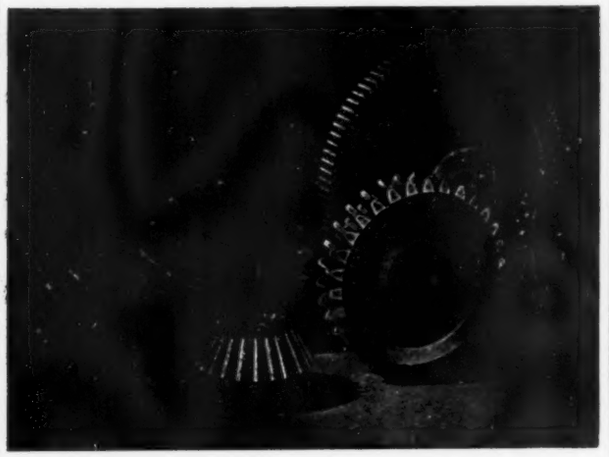
Geared TO DO THE JOB

Common sense rules out the publication of specific facts and figures. But it's no secret that PERKINS GEARS are integral parts of airplane engines which power some of the deadliest fighters and bombers in the world.

Perkins produces every type of precision gear exactly to your specifications, from any material, in any quantity, for aircraft motors, precision instruments or any other equipment needed for Victory.

PERKINS PRECISION, CUSTOM-CUT GEARS
help power American Planes

PERKINS MACHINE & GEAR COMPANY
SPRINGFIELD, MASS.
"Throw Your Scrap Into The Fight"



"From the smallest Gear up to 72" diameter.

"Whether your drawings call for standard or special Gears, you will find Grant Gears will give you the high efficiencies and economies that present-day requirements demand."

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GEAR CUTTING MACHINES

New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY

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PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
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FINE GEARS of All Types and Sizes
Spur Gears—½ in. to 30 ft. in diameter
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Worm gears in any practical size
THE EARLE GEAR & MACHINE CO.
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EARLE GEARS

The Doorway to 37 Years Experience is Open to War Production

Our new facilities enable us to take fullest advantage of our long experience in gear making for the benefit of the war effort.

All we brought with us (when we moved across the river from New York to New Jersey) was 37 years experience as specialists in precision gear making. Instead of taking our existing equipment along, we installed new machines of the very latest type—gear shapers, automatics, millers, hobbers, grinders, lathes, radials—machines which are being featured currently by their builders for their speed, accuracy and convenience. These machines, in the hands of men skilled in every detail of fine gear making, are busily engaged in the new Sier-Bath plant, turning out precision gears in quantity to most exacting specifications.

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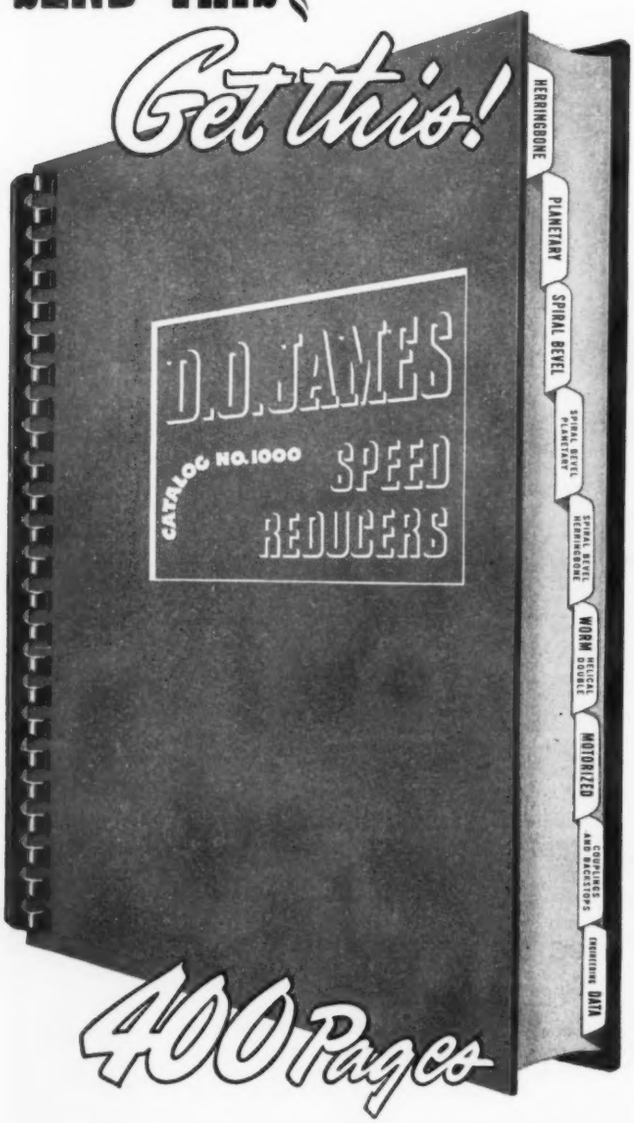

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OVER FIFTY YEARS MAKERS OF ALL TYPES OF GEARS AND GEAR REDUCERS

Gear Specialties

SPURS • HELICALS • BEVELS
(Straight & Spiral)
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(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

Gear Specialties
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MP **QUALITY GEARS CUT TO ORDER** MP

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

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FOR SIXTY YEARS
Spur – SPEED REDUCERS – Worm
ALL TYPES OF CUT GEARS
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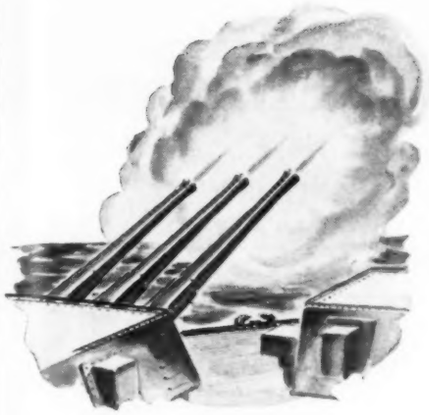
GEARED FOR VICTORY
Bevel-Spur-Worm-Helical
THE TAYLOR MACHINE COMPANY
1917 East 61st St. Cleveland, Ohio
"TAYLOR - MADE"



More Power to 'Em!

Translating the high speed revolutions of a motor into the slow driving power of an ammunition hoist means a slowdown in speed—an increase in power.

Foote Bros. speed reducers have the rugged construction, the simplicity, the high efficiency and smoothness of operation that have won their acceptance by the Navy on our new battleships.

The lessons learned in the laboratory of war—the refinements made necessary in reduced size, reduced weight, increased efficiency and dependability, all spell new and improved speed reducers for industrial applications such as conveyors, elevators, agitators, mixers, dryers, kilns, hoists and mills when the war is over.

The plant of Foote Bros. Gear and Machine Corporation is today a huge laboratory developing new techniques in engineering and new techniques in producing better gears and better speed reducers. These developments promise peacetime gears and speed reducers that will enable American manufacturers to provide better machines at lower cost.

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ACCURACY PLUS

★ SPUR
★ BEVEL
★ HELICAL
★ SPLINE
★ WORM
★ SPECIAL

You are assured of ACCURACY, PLUS . . . performance, quality, quietness . . . and The Right Gear For The Job when you specify "CINCINNATI GEARS".

For more than forty years the skill of our engineers and craftsmen have combined to produce *"Gears, Good Gears Only"*

KEEP'EM ROLLING!

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"Gears . . . Good Gears Only"
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THE JOHNSON FRICTION CLUTCH

Single

THE NEW "MAXITORQ" MULTIPLE DISC DESIGN.

Double

Has Floating Plates in Neutral

. . for maximum serviceability in minimum space

The adaptability of JOHNSON FRICTION CLUTCHES to hundreds of different kinds of machines has been possible by the compactness of these sensitive durable units.

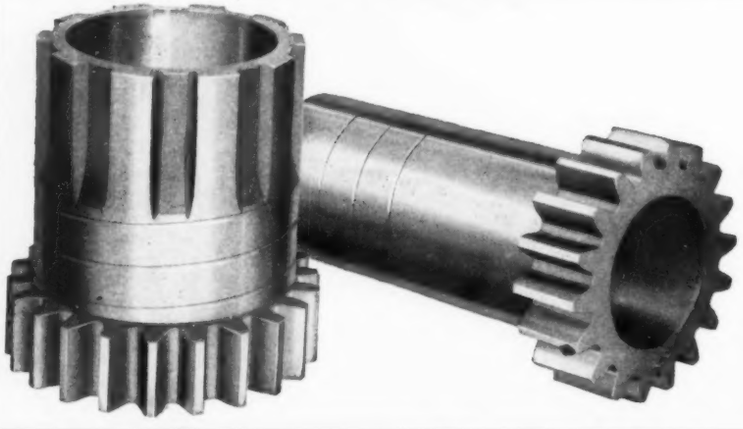
Many leading manufacturers of industrial machinery have standardized on JOHNSON CLUTCHES because their adoption involved minimum changes in design, and assured a maximum in clutch performance.

In addition to compactness, JOHNSON CLUTCHES offer quick, smooth starting. They are available for high speed, can be depended on for safety, durability and economy.

Let us show you how easy it is to engineer the JOHNSON CLUTCH into your machines. Just send us details of how you propose to apply the clutch. Ask for our assistance today.

Write for Multi-Disc Clutch Catalog No. 105 or consult Sweet's or Thomas' Register

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



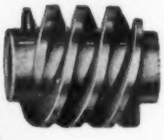
ADAMS GEARS

SPUR — HELICAL — WORM
BEVEL — MITER — RACKS

Splined Shafts A Specialty

THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa

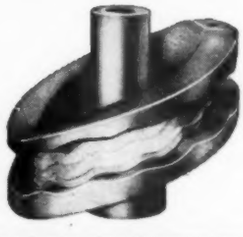
"HARTFORD" for Gears, Cams, Thread-Grinding



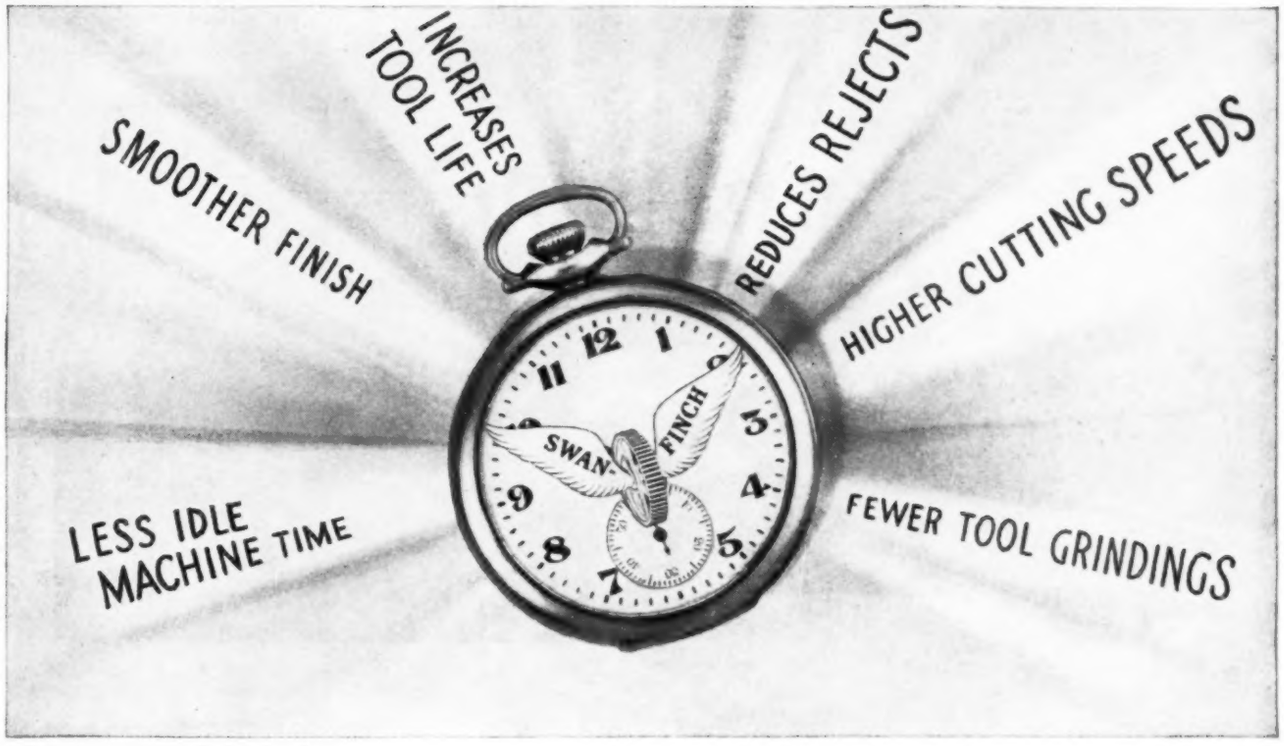
OUR SERVICE INCLUDES:

- . . . cutting gears of every description exactly to specifications
- . . . grinding gears, cams and threads
- . . . furnishing aeronautical parts on a contract basis

You plan and we execute—assuring speedy production, prompt delivery and reasonable price. Send blue prints or samples for estimate.



THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.



SAFCO METAL WORKING LUBRICANTS

are proved time-savers!

Over and over again it is being proved on the job that 'SAFCO' lubricants are time-savers — — — increasers of production.

Hundreds of reports from highly engineered plants, (many outstanding leaders in vital war production), *prove* that 'SAFCO' can bring amazing increases in production.

For over 40 years, SWAN-FINCH, makers of 'SAFCO' products, have been leaders in the highly specialized field of Metal Working Lubricants.

Today as never before our specialized experience is proving its value in helping machine shops meet new and exacting production requirements.

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

For instance meet E. E. Jensen. He is one of our highly trained and experienced staff of fieldmen.

ASK US TO HAVE HIM CALL — NO OBLIGATION.

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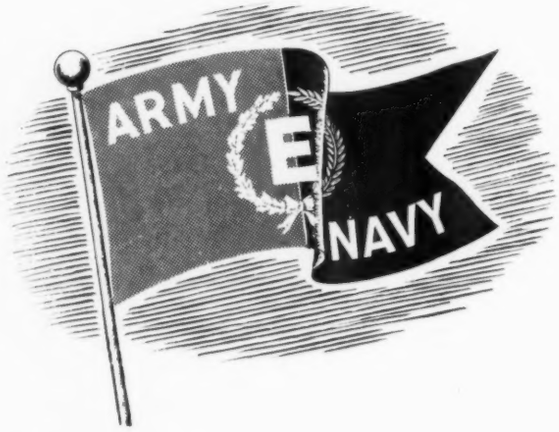
Detroit, Mich.	2596 Hart Avenue	Detroit, Mich.	2596 Hart Avenue

For MERITORIOUS SERVICE



Pride in accomplishment alone is an empty thing. We are proud, of course, that H-W Small Tools and Thread Milling Machines are worthy of recognition. But it is even more gratifying to see a loyal and efficient personnel rolling them off the production lines faster and better than ever before. Best of all is the genuine thrill of knowing that on the other end of the chain . . . the first link of which we help to forge . . . is a first class fighting man who, perhaps because we did our job well, will be able to give 'em hell just a little more effectively. And this, after all, is the American Way . . . to do our job, each one of us, to the best of our ability . . . to contribute, to the best of our ability, to the winning of the war.

The HANSON WHITNEY

MACHINE CO HARTFORD CONN.

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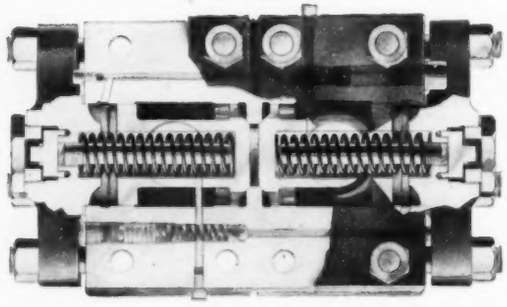
● A problem presented—studied—solved! It's the firm policy of BAYARD to follow through every assignment in the designing, engineering and creating of machinery for a specific purpose with ingenuity and skill born of long years of experience.

SPECIAL VALVES
ELECTRO-HYDRAULIC
HOISTING MACHINERY
CRANES

DUPLEX RELIEF VALVE
for Closed Hydraulic Systems
Relieves excessive pressure from the high side to the low side, independent of which side of the system happens to have excessive pressure.



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The coveted Navy "E" Pennant—awarded to Bayard for excellence in fulfilling Naval contracts

M. L. BAYARD & CO., Inc. • ENGINEERS • MACHINISTS • PHILADELPHIA

AIR EXPRESS GAINS SHARPLY

Express carried by commercial air lines in first six months of this year gained sharply over a year ago, according to AIR EXPRESS DIVISION of Railway Express Agency. It said movement of essential materials was largely responsible.

In order that air lines may utilize cargo space more efficiently, shippers are urged to forward traffic earlier in the day, when more space is available than on night flights.

Taken from Boston News Bureau, August 22, 1942

You do not need a priority to ship by AIR EXPRESS, but if you have war production shipments requiring priorities, they will be granted. Phone Railway Express Agency, AIR EXPRESS DIVISION, or any air line.

NOW IN ITS 16th YEAR

AIR EXPRESS

Division of RAILWAY EXPRESS

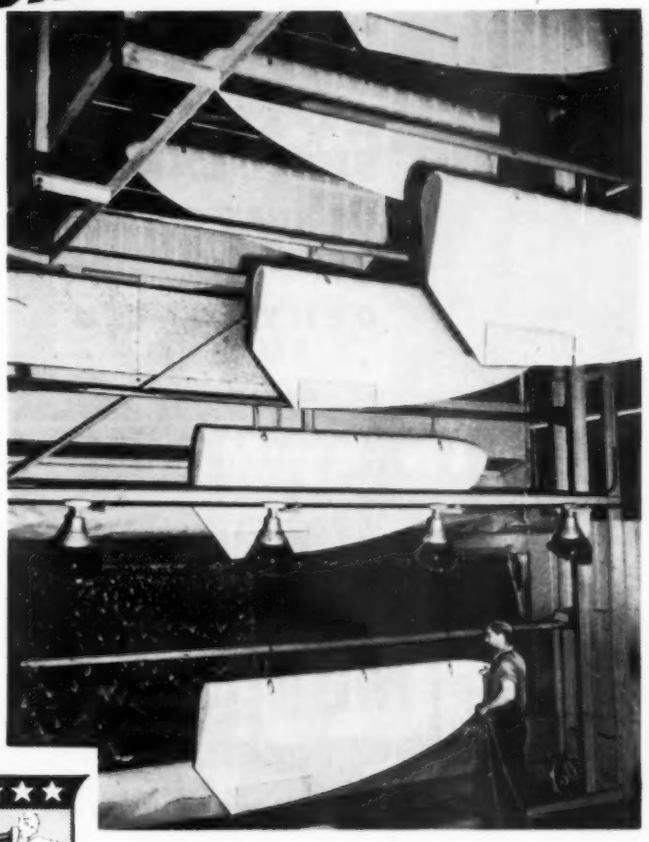
★PLANE PARTS PRODUCTION INCREASED (CENSORED) % WITHOUT INCREASING FLOOR SPACE!

*How Alvey-Ferguson Conveyor System Utilizes Overhead Waste Space To Eliminate Bottlenecks In Fleetwings' Finishing Operations . . .

PROBLEM: Parts to be finished were light in weight but large in area. How could such parts be stored and moved, *while drying,* without the addition of huge floor areas or the creation of a serious production bottleneck?

With the cooperation of Fleetwings' plant engineering staff, Alvey-Ferguson engineers designed and built an "endless-stream" *conveyor system which required no floor space!* Unused space overhead was utilized to move the parts at exactly the right speed for continuous processing.

Photo at right—*Operator sprays one side of fabric-covered aircraft tail surface as A-F Conveyor brings tail-piece down slowly in front of spray booth. Tail-pieces returning from opposite spray booth, where other side has been sprayed, are visible at top.*



At Left—*Double-chain overhead A-F Conveyor, from which tail-pieces are suspended, is driven at the right speed to provide drying time before parts return to unloading level. Speed can be changed by adjustable-speed pulley shown in lower half of illustration.*

Whatever your products handling, material handling or metal products washing problem, our experienced engineers can solve it for you. Without obligation on your part, write, wire or telephone The Alvey-Ferguson Co., Dept. AM, Disney Street, Oakley Station, Cincinnati, Ohio.

ALVEY-FERGUSON
Conveyors
AND PRODUCTS A-F CONVEYING MACHINERY WASHING MACHINES

SEAMLESS TUBING
ROTATING SHELL BANDS
OF PURE COPPER OR GILDING METAL
DEHYDRATED TUBING

LEWIN MATHES

LEWIN-MATHES COMPANY • • SAINT LOUIS, MISSOURI

Patent

UNIVERSAL BALL JOINTS

- Made in a range of 9 sizes for shaft diameters ¼" to 1⅛".
- Standard Joints have maximum angle of 38° from the straight line.
- Made by the largest manufacturers of UNIVERSAL JOINTS in Great Britain.
- Widely used in Machine Tools, accessory drives and on Aircraft.
- Certified 92% to 98% efficient by the British Government's National Physical Laboratory.

Catalogues on request.

The
MOLLART
Engineering Co., Ltd.

KINGSTON BY-PASS, SURBITON, SURREY, ENGLAND.
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★ *Woodworth employs a nearly equal number of men and women. By Mid-Winter, personnel records will show 80% women and 20% men.*

TO N. A. WOODWORTH MEN AND WOMEN FOR *"Outstanding War Work"*

Men and women of N. A. Woodworth Company have received the only military decoration given to civilians, the Army-Navy "E" Award. ★ ★ ★ This signal honor has been accepted with sober consideration of the greater responsibilities it demands. Having publicly acknowledged our production accomplishments, the Army and Navy expect us to maintain and even surpass past efforts as America's Armed Forces step-up the military pace against Axis aggression. ★ ★ ★ Mighty bombers, deadly fighter planes are impotent if integral engine parts fail to stand the stress of combat flying. In manufacturing over 100 highly precisioned engine parts, Woodworth employes keenly feel their responsibility in this country's war effort. ★ ★ ★ Management and labor are pledged and anxious to meet any new production goals and mechanical requirements set forth by the Army and Navy to always be worthy of the "E" Award.

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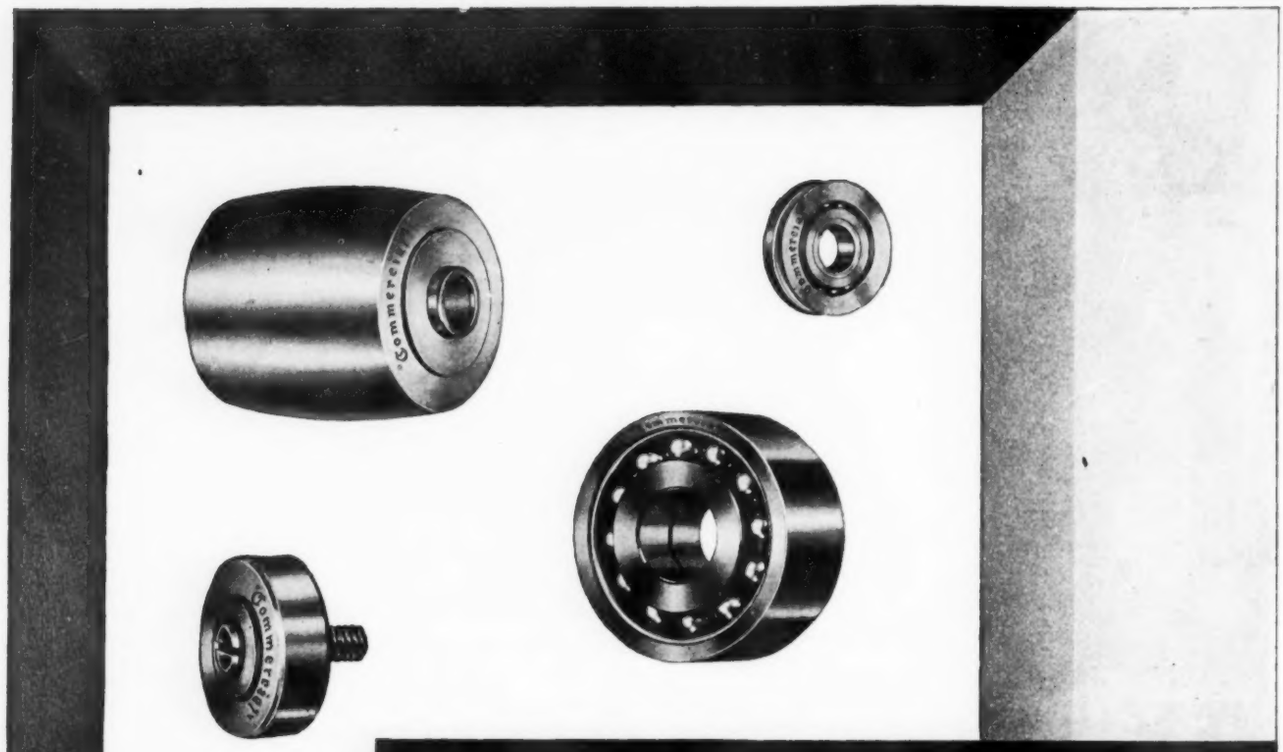

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BALL BEARINGS FOR EVERY PURPOSE

"Commercial" Annular Ball Bearings are available in nearly all standard types and sizes. We also manufacture SPECIAL types of bearings designed for particular purposes—to meet your own needs and specifications. On this page, we illustrate special **"Commercial"** bearings used in various products. For instance:

BALL BEARING ROLLERS FOR TYPEWRITERS.
BALL BEARINGS FOR STRAIGHT EDGE CABLES.
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TAPE ROLLER OR PULLEY FOR PAPER FOLDING MACHINES.

This gives some idea of the wide variety of bearings manufactured by us. All **"Commercial"** Bearings are precision built, accurate, tough and provide efficient, satisfactory service under all conditions.

Whether you need a few, or a great many units, our Engineering Staff will be pleased to assist in solving your ball bearing problems. Send for complete information and latest catalog.

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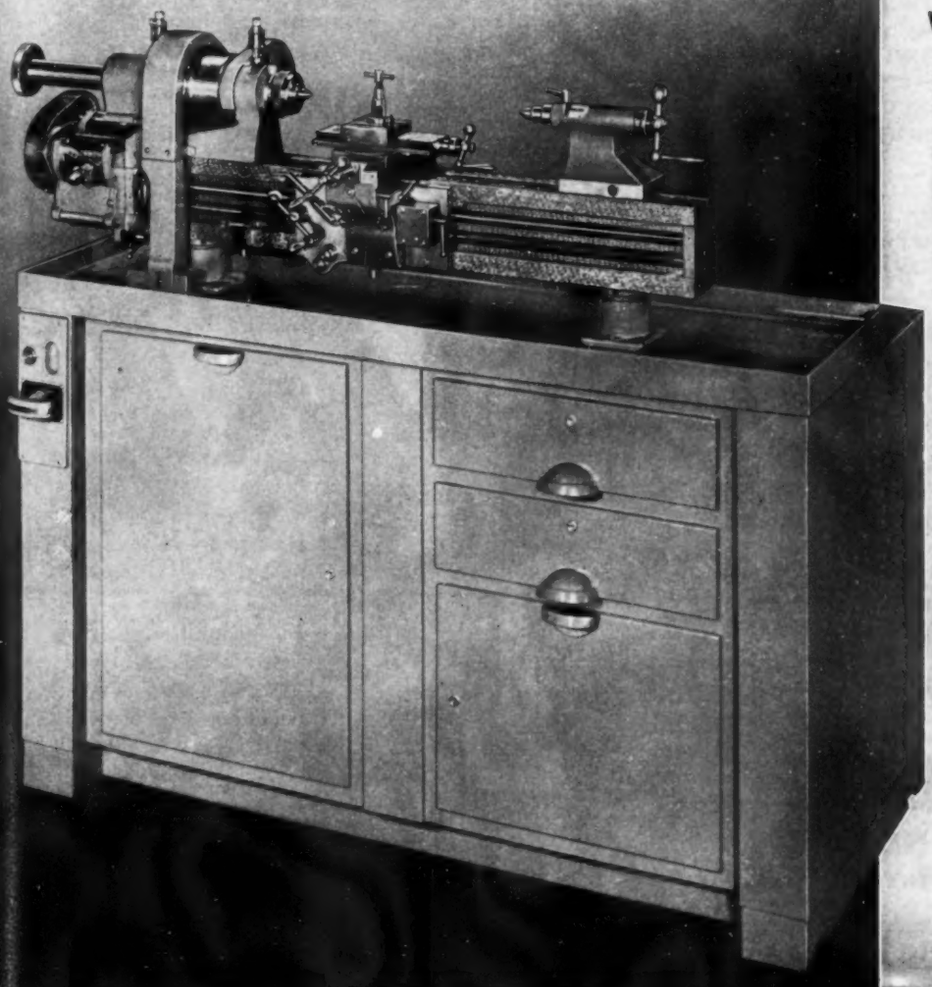
RIVETT

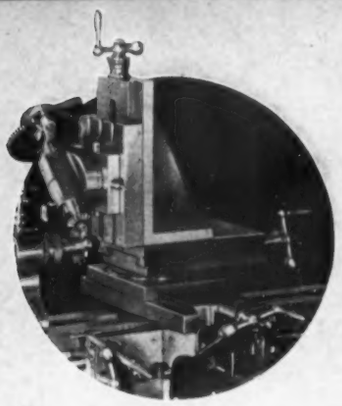
608 WITH VEE BELT DRIVE

In Tool-Making and Instrument Shops It Will Handle Great Variety of Jobs in Minimum Time

Basically, the Rivett No. 608 is a small but exceedingly powerful engine lathe. As such it is peculiar in having slide areas equal to those of lathes twice its size. Its bronze-bearing spindle runs smoothly and with extreme truth, and is capable of heavy or light cuts and severe end thrusts. Finely made attachments for milling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations enable the user of a fully equipped No. 608 to finish his work completely without resource to other machines, and throughout the entire series of operations to utilize the inherent precision of the lathe itself.

Safety interlock protects the carriage from accidental engagement of both power feed and lead screw. Lead screw and feed rod are guarded from injury by deeply inset mounting in bed. Carriage wipers sweep dirt and chips from the bearing surfaces of the bed. Three-point pedestal supports assure against distortion imparted from lathe mount.





Milling

Multiple Operations

6 0 8 GEARED BENCH LATHE

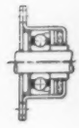
SPECIFICATIONS

With Flat or Vee Belt Drive

Swing over bed, dia.	8½"
Length of bed	40"
Distance between centers	18¼"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of top slide	5¼"
Slide rest, travel of cross slide	4½"
Feed range, through gear box	.0015" to .0220"
Thread range, through gear box	10 to 144
Tailstock spindle travel	3¼"
Spindle speeds:	
Flat belt drive—12 speeds	39 to 1295 r.p.m.
Vee belt drive—12 speeds	25 to 1500 r.p.m.
Weight of lathe, mounting and drive:	
Flat belt drive, net	900 lbs.
Vee belt drive, net	1050 lbs.

For Further Description Write for Bulletin 608

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT



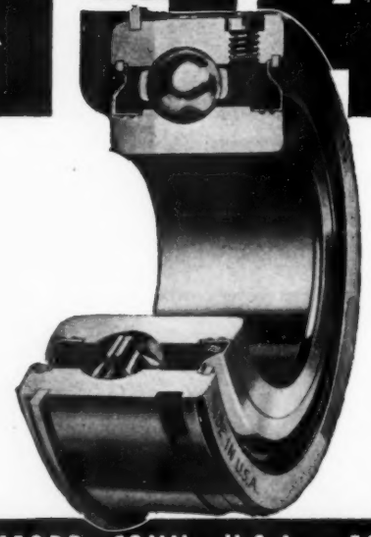
1921 1923 1925 1927 1929 1931 1933 1935 1937 1939 1940 1942

TIME *Marches On*

In 1921, NORMA-HOFFMANN introduced the Cup Mounting—the forerunner of all self-protected ball bearings. From this, through progressive stages (as shown above) has evolved the NORMA-HOFFMANN "CARTRIDGE" BALL BEARING—an ultra-modern type embodying 30 years of PRECISION BEARING manufacture and offering to industry the following distinctive advantages:

SIMPLER AND MORE ECONOMICAL MACHINE DESIGN, due to elimination of many costly mounting parts and machining operations, otherwise required; EASIER AND FASTER MACHINE ASSEMBLY AND DISASSEMBLY, since the "CARTRIDGE" BEARING is an integrally sealed unit needing no complementary mounting parts; 100% GREATER GREASE CAPACITY, due to double-row width creating a greatly enlarged grease reservoir; COMPLETE AND LASTING EXCLUSION OF DIRT AND FOREIGN MATTER by the use of tightly fitting, wearless, all-metal seals; SEALED FOR ANY POSITION, since the seals retain the lubricant regardless of shaft angle; EASY REGREASING AND INSPECTION WITHOUT DISMOUNTING, by means of refilling plug and removable seals.

Write for the Catalog. Submit your bearing problems for study and recommendation, without obligation. NORMA-HOFFMANN sales and service engineers, and distributors in principal cities stocking "CARTRIDGE" BEARINGS, are at your service.



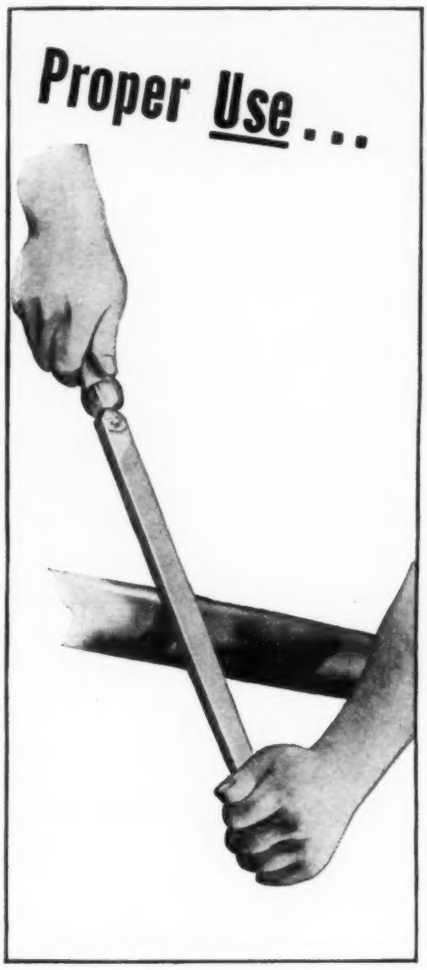
"NORMA-HOFFMANN"

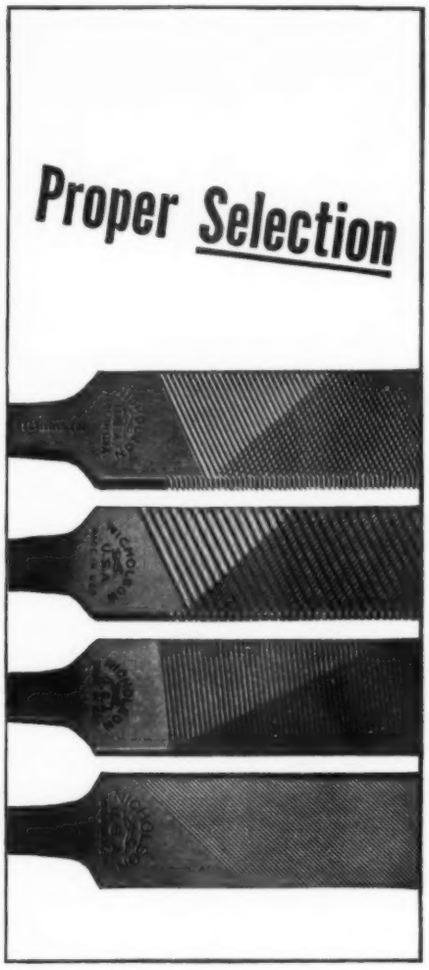
CARTRIDGE

BALL BEARING

PRECISION BALL, ROLLER and THRUST BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN., U.S.A. • FOUNDED 1911





...saves time—saves materials—saves files

This is a war in which conservation is as important as *production*. It applies to tools as well as to materials and products. And few tools serve more widely than files.

Machine-shop and industrial concerns are having to get along with more and more inexperienced workers. Waste from improper file use, care and selection is becoming a growing problem.

Superintendents and foremen *can* do something about it. Posting or circulating the rules of proper file use and care suggested at the right will help to improve the worker's efficiency, save his time, increase his output, conserve materials, reduce spoiled work, make files themselves last longer (conserving file steels, too).

Nicholson has literature useful as "shop-school texts." Write us on any problem or efficiency program in which our experience with files and filing might be helpful. For your file needs, consult your mill-supply house.

* ***Free Technical Bulletins*** on Nicholson or Black Diamond Special Purpose Files for: Stainless Steel, Aluminum, Brass, Lathe Filing (these four illustrated above), Die and Foundry Castings, Plastics, Die Making, Shear Tooth Filing.

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ontario)

"DO" and "DON'T"

- Use *The right file for the job.**
- Don't "tear" into the work with too much pressure on the forward stroke.
- Don't "drag" the file back under needless pressure.
- Don't throw files among other tools or objects.
- Don't stack files against, or lay them on top of, one another.
- Keep files dry so rust will not corrode their cutting edges.
- Keep files clean of filings. After every few strokes, tap file on bench or wooden object to loosen chips. Brush file frequently with file brush or card; and always before putting the file away.

NICHOLSON FILES

FOR EVERY PURPOSE

NICHOLSON U.S.A.
MADE IN U. S. A.

Ten years' test makes Star best

• STAR "Moly"* High Speed – the first molybdenum alloy hack saw blade–the only genuine "Moly"*–is the result of ten years' testing by thousands of plants on heavy-duty metal sawing–the result of ten years' improvement in steel, heat treatment and uniformity.

Because of this head start, today's STAR "Moly"* High Speed is unexcelled for swift sawing and long life. For high speed sawing – hand or power – demand STAR "Moly"* High Speed. Look for its all-over copper metallic finish.

INEXPERIENCED WORKERS CAN'T BREAK

STAR Unbreakable Special Flexible in use in a frame. Yet this blade cuts and lasts like an all hard, speeding sawing and reducing blade-changing time. All-over green metallic finish.

TRADE MARK

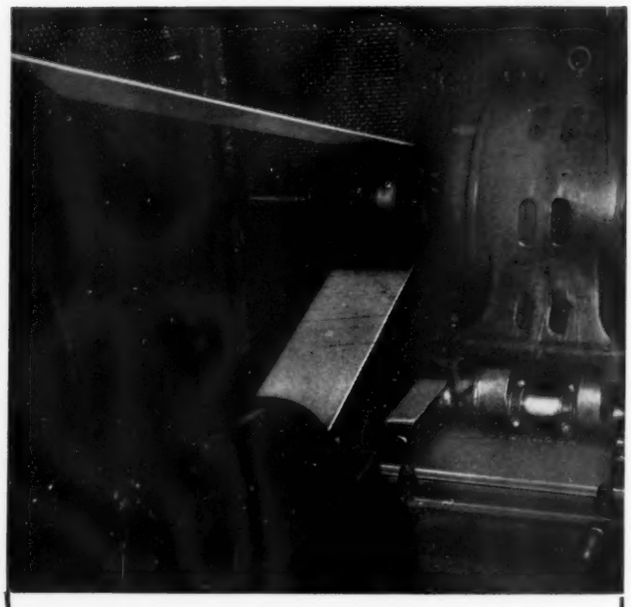
CLEMSON BROS.

Incorporated

MIDDLETOWN, NEW YORK

**T. M. Reg. – introduced, and made only by Clemson Bros., Inc. and affiliated companies.*

613



GREATER HOURLY PRODUCTION EVERY HOUR OF THE DAY . . .

with new or old machines!

Tannate-Rockwood pivoted motor base drives keep production at a steady, high rate whatever the fluctuation in load. If the load varies, the weight of the motor on the Rockwood pivoted base automatically adjusts belt tension. The Tannate belt delivers to its machine maximum power even at peak loads.

Tannate leather belting has long service life and requires little maintenance. Prestretched and treated to resist moisture, machine oil and many chemicals, Tannate stays on the job with minimum time out for take-ups or repair.

Tannate-Rockwood drives can give new vitality to old drives and keep new installations at peak efficiency. Why not give them a trial in your plant?

J. E. RHOADS & SONS

Established 1702

35 N. Sixth St., Phil., Pa.

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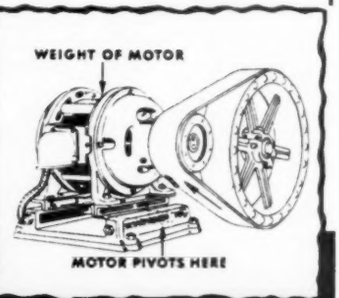
NEW YORK • CHICAGO • ATLANTA • CLEVELAND



RHOADS

Tannate-Rockwood

PRODUCTION DRIVE

It pays to standardize on "HALLOWELL"

"Joe tells me you doubled your assembling capacity. Built an addition?"

"No — just re-arranged our 'Hallowell' Work-Benches. It's easy as pie."

One of the advantages of standardizing on "Hallowell" is that you can re-arrange and add to your set-up at any time to meet greater needs or changed requirements. They are of sturdy construction and easy to install, too. Our catalog shows many of the 1367 combinations available.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

— BRANCHES —

BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO

HALLOWELL

SHOP EQUIPMENT

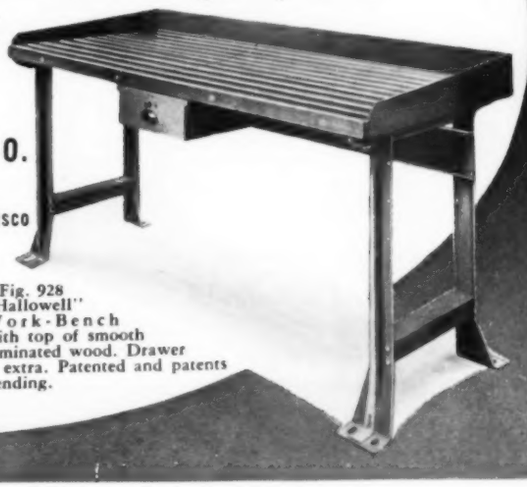


Fig. 928 "Hallowell" Work-Bench with top of smooth laminated wood. Drawer is extra. Patented and patents pending.

WRIGHT

Improved High Speed HOISTS

ARE FAMOUS FOR THEIR ABILITY TO STAND ABUSE—HELP THEM TO TAKE IT NOW—PROTECT THEM

The No. 1 precaution is: ***Don't Forget the Grease Gun!*** A busy **WRIGHT HOIST** needs thorough lubrication once a month. Keep your load chain well lubricated, too.

Wright's No. 2 precaution is: ***Don't Overload Your Hoist.*** Watch both the top and bottom hooks if in doubt about the carelessness of workmen. Wright hooks are drop-forged from special steel which, when overloaded, give visible warning by slowly opening. Wright load chains are also high in elastic limit. Don't continue to use hooks or chains that have stretched.

Take proper care of your **WRIGHT HOIST** so that it lasts. Where properly lubricated and maintained, many **WRIGHT HOISTS** have given continuous, trouble-free service for 20 to 25 years. You can find the name of your nearest Wright distributor in the telephone book.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, San Francisco, New York
In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

At all points of attack in mechanized war, mechanical strains and vibrational stresses reach new highs. At the same time, Allen Hollow Screws reach new highs of *resistance* to these stresses.

Your "Allens" HOLD. They are steeled to hold, threaded to hold, hardened to hold. They make fast your machine assemblies with a weld-like rigidity at the critical points.

Better hold *exclusively* to the hollow screws that for 32 years have been toughened to "take it" *NOW!*

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

SOLVES MANY PROBLEMS

"MORRISFLEX" Machines, in universal use throughout the Aircraft and General Engineering Industry, can be relied upon to give unfailing service, under all conditions. For Grinding, Polishing, Scarfing, Frazing, and *any* special operation allied to the Polishing Industry, they are indispensable. Solid in construction yet easy in operation particularly are they to be recommended in these days when women are replacing men in industry, and the saving of energy is of national and vital importance. The range of "MORRISFLEX" Machines satisfies all demands.

MODEL M102
OVERHEAD
SUSPENSION
TYPE

YOU SAVE TIME LABOUR and ENERGY WITH

Morrisflex

FLEXIBLE SHAFT EQUIPMENT and REX ROTARY FILES and CUTTERS

"Rex" Rotary Files and Cutters are unrivalled and standard sizes are in constant production. "SPECIAL" are made to order.

Morrisflex Equipment is standardized in the leading Aero and Aero Engine Factories and other important manufacturing concerns of many kinds.

B. O. MORRIS LTD. • SHIRLEY, BIRMINGHAM, ENGLAND

Have You a Special Plate Problem?

LOMBARD GOVERNOR- for precision production work—is making accurate and specially heat treated Angle Plates, Scraped V Blocks, Lapping Plates, True Surface Plates, Bench Plates, Parallels and Straight Edges. Making these essential inspection parts requires an engineering knowledge which is available to you for your special plate problems.

Send us your drawings and we'll be glad to quote.

LOMBARD GOVERNOR CORPORATION
200 MAIN ST., ASHLAND, MASS., U. S. A.

PUT YOUR COLD METAL SAWING ON A LOW COST, HIGH PRODUCTION BASIS.. *with this NEW* PORTER-McLEOD MACHINE

Especially designed for stepping-up speed of cutting stock from 3 inches up, the Porter-McLeod 8" Cold Metal Sawing Machine is a money saver that quickly pays for itself.

Driven by a 5 H. P. enclosed motor and conveniently controlled by push button, this new machine makes big savings on general work or on production work involving single or multiple units. Because of its capacity and upper feed it is possible to "nest" economical quantities of bars and shapes so that several pieces can be cut at one time. The standard 3 inch feed of this machine can be increased for cutting brass and non-ferrous metals.

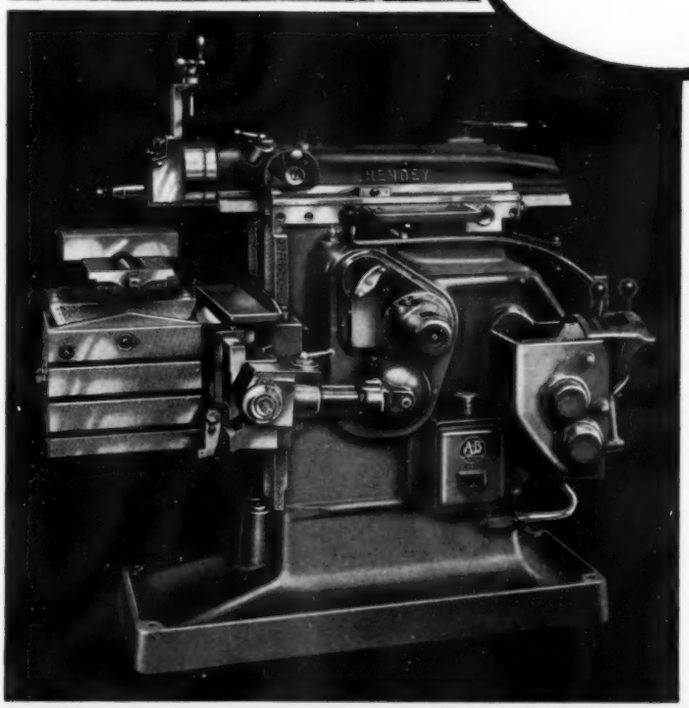
Features which make this machine particularly advantageous for fast accurate production of larger sizes of stock include: support of blade close up to its rim and pulling of blade through the cut, a design which prevents buckling of saw, eliminates weaving, insures maintenance of accuracy and straight cuts; feed is by friction disc which insures against blade breakage especially when hard spots are encountered in the stock being cut.

Get all the details of this new machine by writing *NOW* for descriptive bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

Blasting the Enemy

PHOTO BY U. S. ARMY SIGNAL CORPS

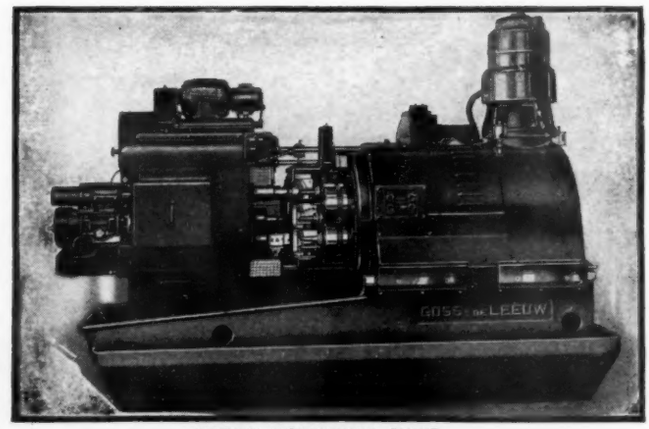


Before these 155 mm. Guns can be made there must be machine tools to do the job. Hendey 12" Crank Shapers have a definite place in the war production program, making precision parts for guns, tanks, ships and planes. 68 Years of manufacturing experience have built dependablility into these Hendey Shapers. . .

1874 - - - 1942

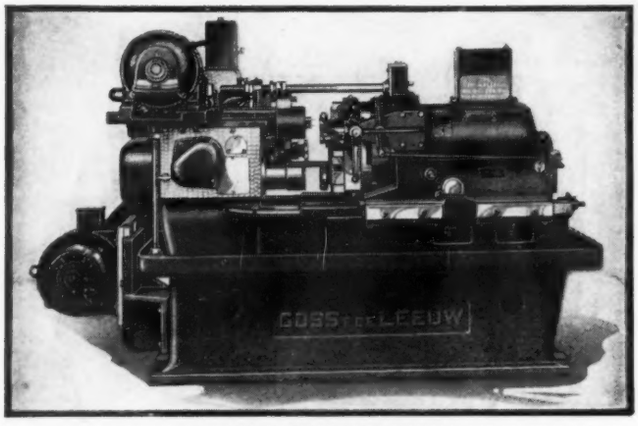
THE HENDEY MACHINE CO., Torrington, Conn., U.S.A.
BOSTON • NEW YORK • ROCHESTER • DETROIT • CHICAGO

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

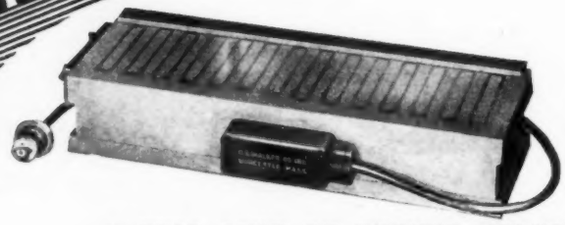
Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

WALKER MAGNETIC CHUCKS

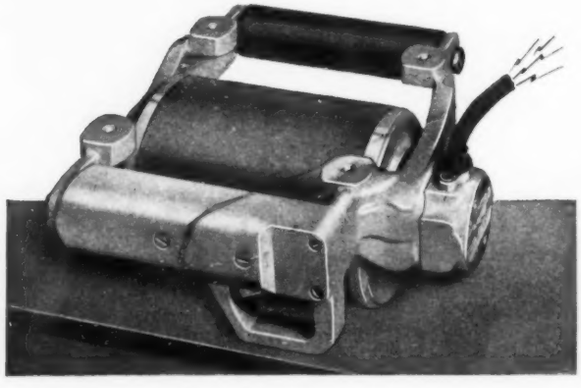
Style B Face Plate — in standard diameters from 10⅞" to 36½" inclusive.



No. 617 Bar Pole Face Rectangular Magnetic Chuck.

DEMAGNETIZERS

Walker DEMAGNETIZERS are available in standard D.C. and A.C. types for either 110 or 220 v. Ask for Bulletin K7 giving detailed specifications.



A FULL LINE OF PROVED STANDARD DESIGNS

Walker offers prompt and complete service on magnetic chucks by carrying in stock a considerable line of Rectangular and Rotary types for use on all surface and internal grinding machines built by American machine tool manufactures. These units—for grinding, milling planing and turning operation—are of proved design and are available in such a complete range of sizes as to enable you to select standard units for practically any chucking problem. Write for bulletin W4 giving detailed information.

Also special CHUCKS *for special* NEEDS

The design of Walker Magnetic Chucks is such that "specials" can be developed and furnished at prices only slightly more than standard units. If you require special magnetic chucks for special purposes, consult Walker and be assured of prompt, economical service.

O. S. WALKER CO., INC.

WORCESTER, MASS.

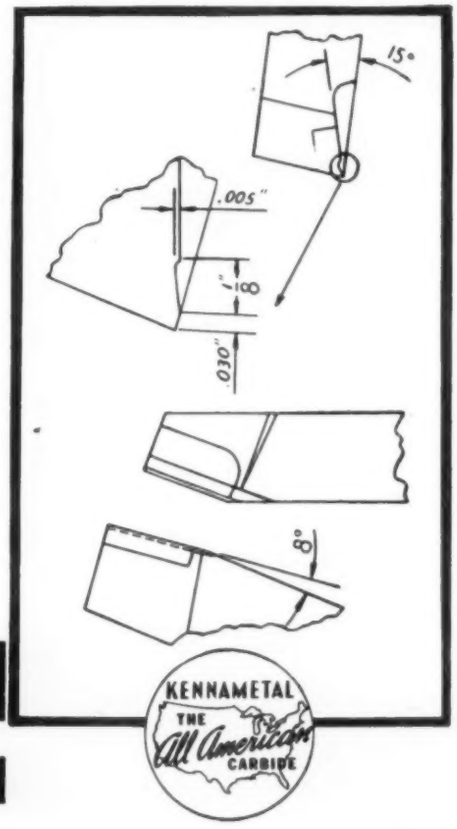
Tom the foreman says:

"IT TAKES GOOD CARBIDE TO DO THIS!"

"Every shop man knows that you can shear off steel chips with less power if your tool has a good side rake. We found Kennametal is strong enough to use 15° side rake on turning tools for tough steel provided we use a negative back rake and a 'flat' on the cutting edge about as wide as the feed. We grind a chip breaker groove ⅛" wide and about .005" deep along the cutting edge, using only a diamond wheel and taking off only ⅓ of a thousandth per pass. We put a 'flat or land' along the edge about 0.30" wide or a little less than the feed.

.."We tested these tools against tools ground the same way with the usual 6° side rake. Sparks, our electrician, was growling about 'overload motors' so we had him hook in his ammeter on the turret lathe where we happened to be turning forgings of SAE 3140. We were running 165 R. P. M. on a 7⅛" diameter, turning flanges with .042" feed. The old ammeter went up to 60 amps with the 6° side rake tool while the high point was only 45 amps using the 15° side rake. Sparks didn't need to tell me it was taking less power. I knew, because I saw the straw colored chips coming off easy with the new tool when they had been blue with the 6° side rake tool. Jim, the operator on the turret lathe says, 'Now, we're going places!', and he proved it, too. As he had to change tools less often and had no blow outs he turned out 10% more work every day last week and we all thought we were doing mighty well before!"

And then Tom says, "Look at these chips off the big boring mill where we used 15° side rake with 8° negative back rake on 45 steel forgings taking a healthy cut of about ¾" deep. I tell you, it took the groan out of those old boring mill gears!"



McKENNA METALS Co.

103 LLOYD AVENUE, LATROBE, PENNA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)

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KENNAMETAL
THE All American CARBIDE

TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

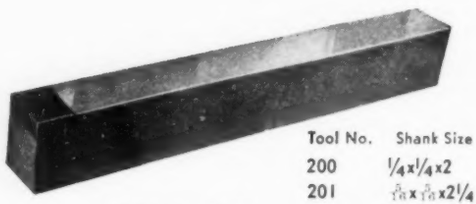
New Low Prices — Increase Production — Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

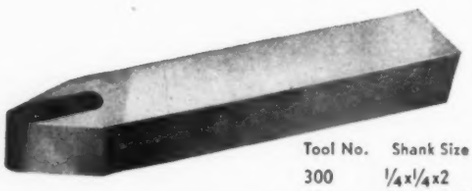
SERIES 100

Tool No. RH	Tool No. LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

WE CARRY SILICON CARBIDE EMERY WHEELS FOR GRINDING TUNGSTEN CARBIDE TOOL BITS

Send for our new 1941 general catalogue

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTER STREET NEW YORK, N. Y.

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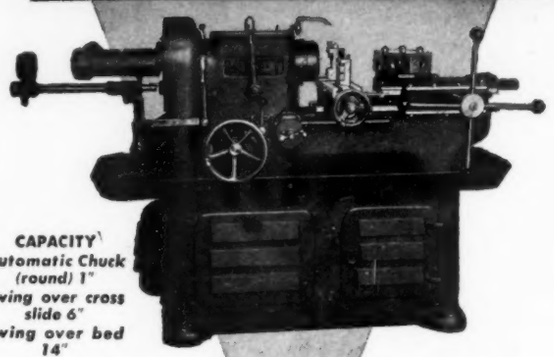
for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds

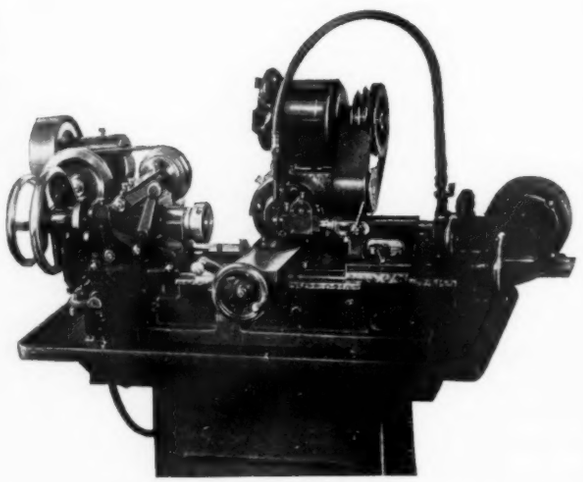


CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools —Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

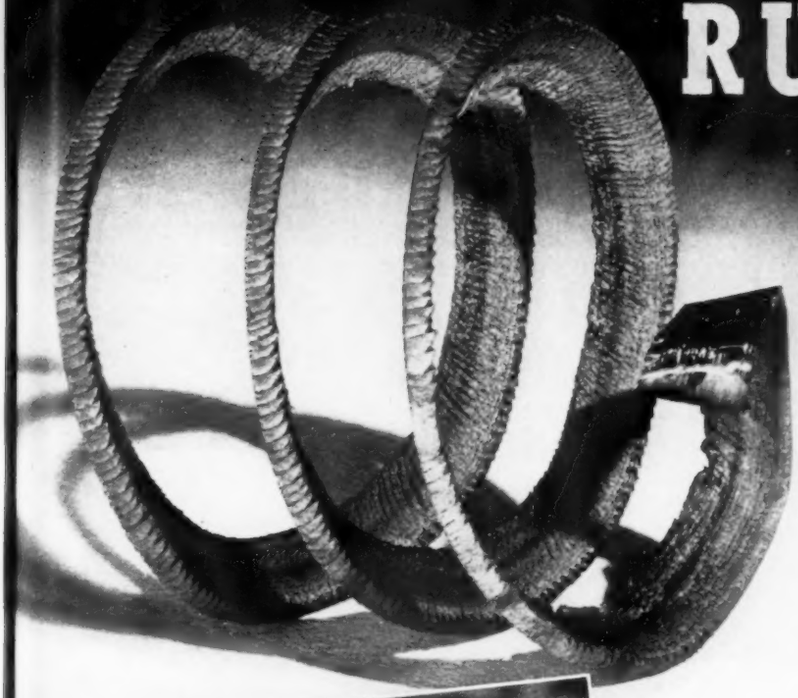


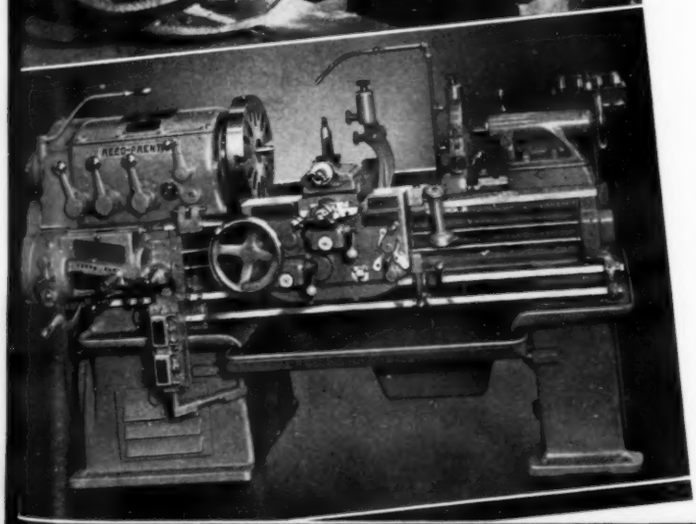
WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET WALTHAM, MASS.

ACCURACY PRECISION RUGGEDNESS





REED-PRENTICE lathes are precision machine tools. They are designed and manufactured to perform to the closest tolerances while turning, threading, or facing, yet one of their outstanding characteristics is ruggedness without sacrifice of accuracy. Our Army and Navy demand durable tools. Illustrated is a test cut at 58 RPM spindle speed, feed rate 80/1000" on a 14" lathe. The chips shown are two-thirds actual size and are being cut from a four-inch bar of .45 carbon steel. We know this operation is unusual, but it shows — Power in Reserve.

ARMY (E) NAVY

REED-PRENTICE CORPORATION 1213 W. 3d St., CLEVELAND, OHIO
75 WEST ST., NEW YORK CITY
WORCESTER, MASSACHUSETTS, U.S.A.

Hammond
OF KALAMAZOO
NEW 20" WHEEL
WET TOOL GRINDER
FOR LARGER CARBIDE AND OTHER TOOLS

Tilting table for carbide tool grinding optional.

8 outstanding features!

(1) New improved combination tool rest and wheel dresser.
(2) Tilting table for carbide tool grinding (optional).
(3) Circulating coolant system features sliding and tilting deflector.
(4) Large sludge pan 24" wide x 35½" long, 8" deep has removable splash guard (shown in phantom) adds protection, aids cleaning.
(5) Heavy ribs and cross sections for Vibrationless operation.
(6) 20" diameter x 2½" face grinding wheel furnished.
(7) Oversize spindle, V-belt driven.
(8) Constant level oiler.

WRITE FOR BULLETIN 101

Hammond 10 and 14 Wet or Dry Carbide Grinder

Hammond Combination Chip Breaker Grinder

Hammond 10-A Dry Carbide Grinder

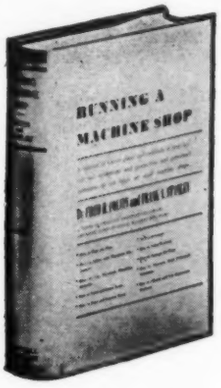
Hammond Machinery Builders INC.
★★★ 1618 DOUGLAS AVENUE ★★★
KALAMAZOO • MICHIGAN
Eastern Branch — 71 West 23rd Street, New York, N. Y.

Is your shop geared for emergency production needs?

How about *management?* Have you taken every means of improving your shop layout and handling of tools, work, records, men, etc., so as to eliminate bottlenecks and put through the greatest amount of profitable work in the busy days ahead? Here's a great new book by the famous machine-shop writers, Fred Colvin and Frank Stanley, in which owners and managers, foremen and shopmen can find practical means of straightening out all the intricacies of running a machine shop for maximum productiveness.

Running a Machine Shop

By Fred Colvin,
Editor Emeritus,
American Machinist,
and Frank Stanley,
Editor,
Western Machinery and Steel World,
403 pages, 6x9, 146 illustrations.. $3.50



HERE is the book to answer the questions that don't have to do with machine operations, yet that affect shop profits in many ways. How to set up and equip the shop, how to plan work, how to inspect and control it, where economies may be made, how production may be improved, how to keep records, how to manage men—these are the sort of important problems explained here on the basis of successful methods now in use.

Here are valuable pointers on:

—selecting machinery
—buying used machinery
—keeping machines in condition
—timesaving tool trucks
—moving work about the shop
—conveyors in the job shop
—toolroom layouts
—making the tool crib pay
—allocating machine hours
—shortening work travel
—estimating on contract work
—estimating from blueprints
—foremen's meetings
—farming out work
—planning for slack times
—modernizing a shop
—where and when to inspect
—saving motions in assembly
—etc., etc.

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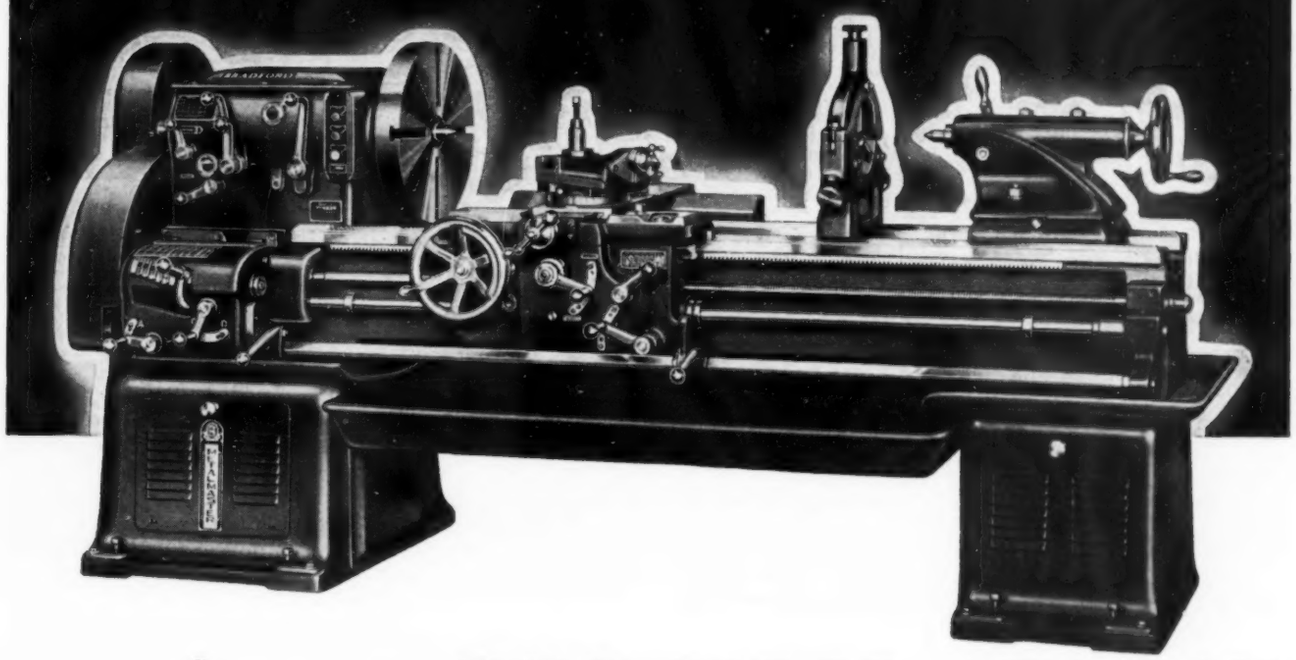
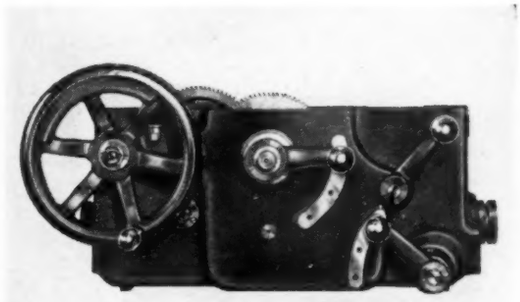
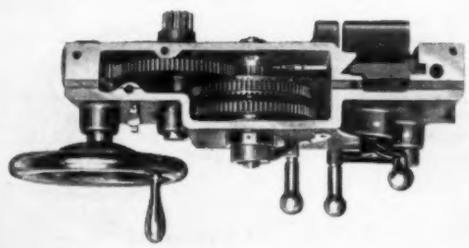
The Metalmaster



• • • has a ONE PIECE APRON!





The Metalmaster's apron is double-walled . . . a one piece casting of box type construction, consequently there are no brackets or supports bolted on, which can work loose and get out of alignment. Shafts and gears are mounted on double anti-friction bearings. Split pattern type half-nuts, engaging both top and bottom of leadscrew, are mounted on rear wall of apron, adjustably gibbed to take up wear. Adjustable stop collars on the feed rod can be set to stop the length feed for turning or chasing, in either direction. Feed gears and clutches dip in a reservoir of oil and supply oil to all shaft bearings . . . feed reversing gears inside the apron are submerged in oil to prevent wear from dirt and chips . . . sight gage on front wall indicates proper oil level to be maintained.

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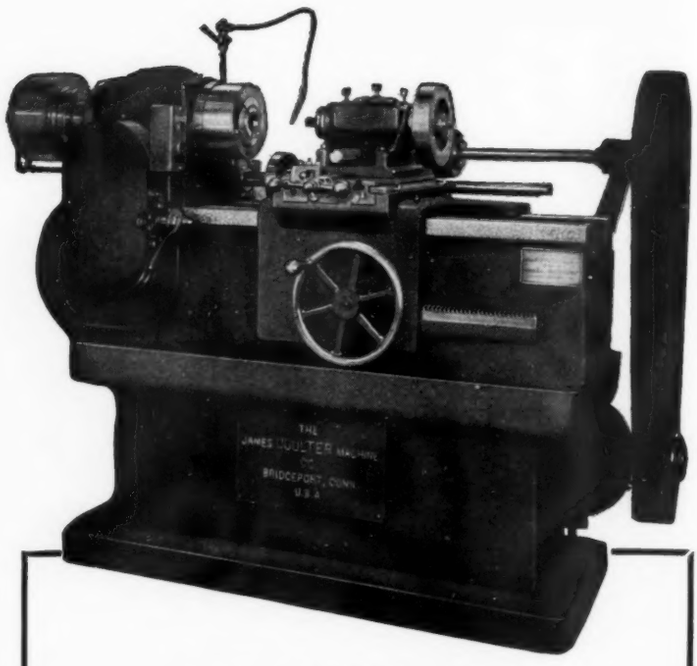

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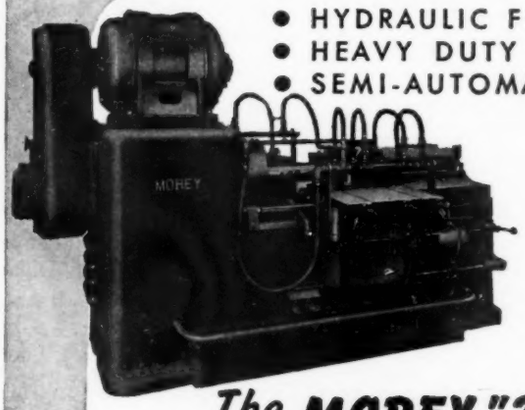

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The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

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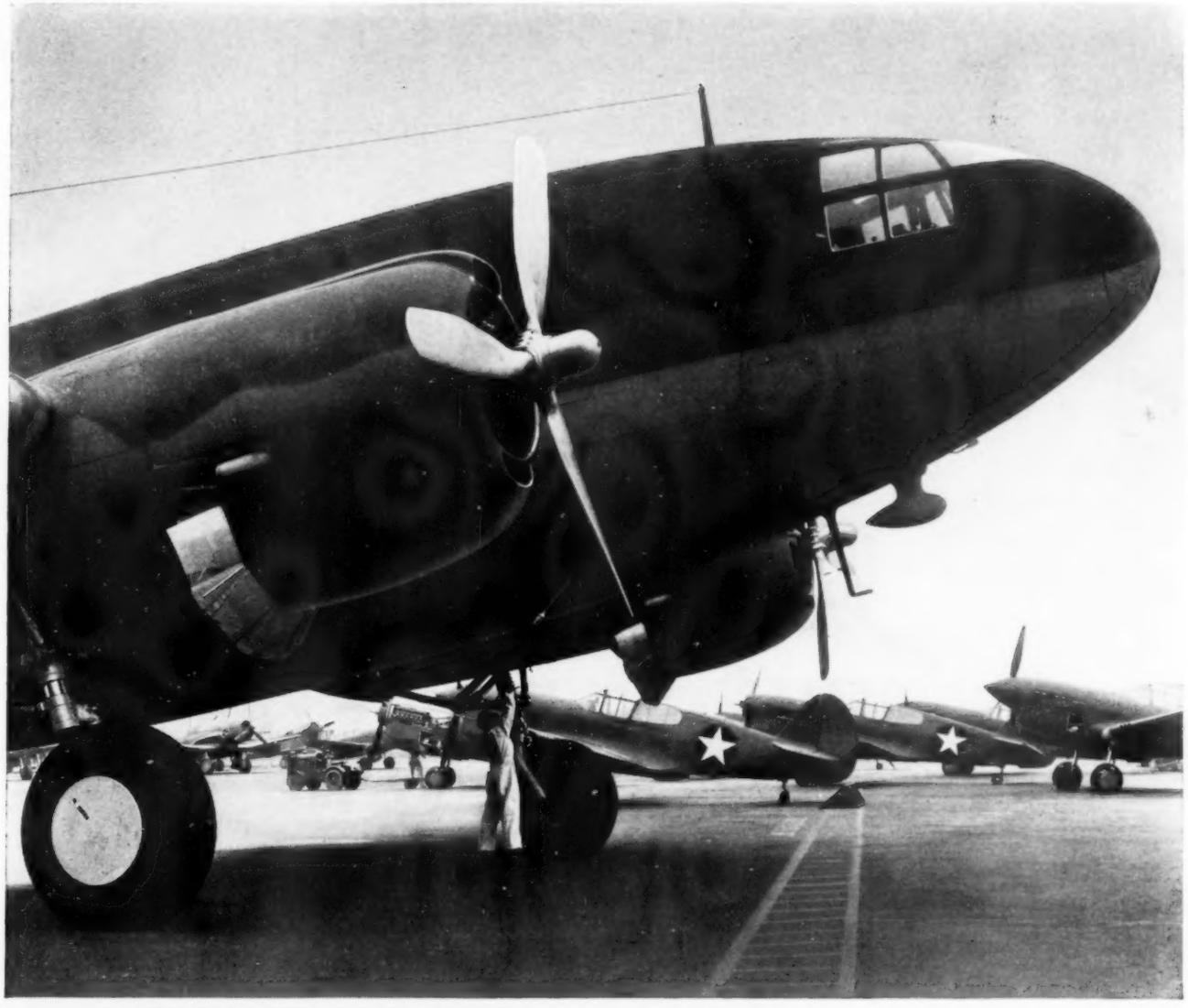

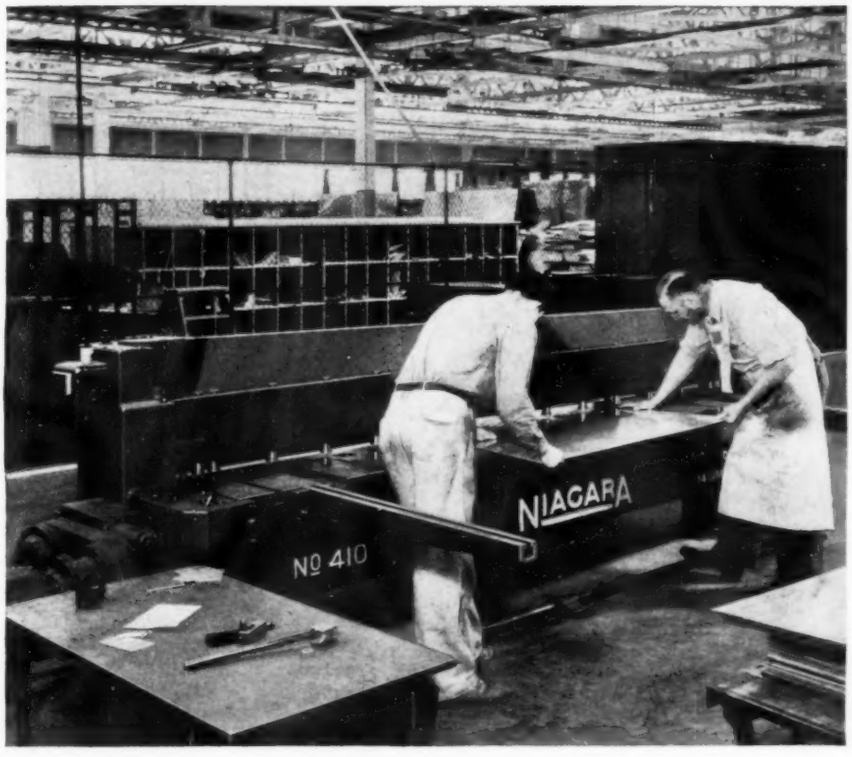

Production of America's largest transport planes and big bombers as well as fighters is being speeded up by batteries of Niagara Power Squaring Shears. Cutting accuracy heretofor unobtainable is made possible by the modern design of Niagara shears. Quick setting gages self measuring to increments of 1/128 inch, flat cutting of narrow strips, drive mechanism enclosed in oil-tight case, instant acting sleeve clutch and full visibility of cutting line are just a few of the many Niagara features.

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Business Week Says-

Hammond CYLINDRICAL FINISHING MACHINE

Faster Grinding

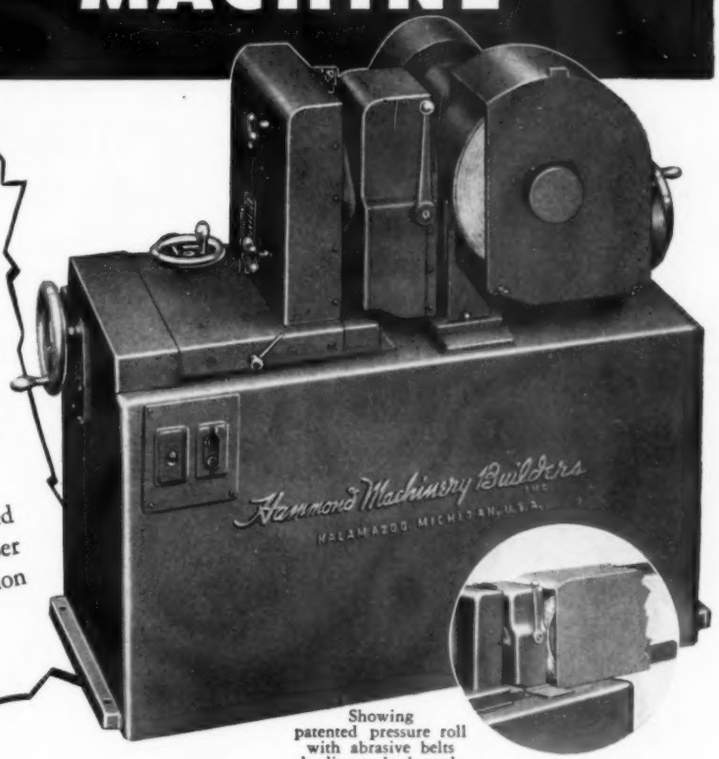
New methods of utilizing surface-coated abrasive belts instead of wheels is said to effect striking savings • some results cited—

. . . A maker of ammunition cases . . . claims production is at 350% former capacity and abrasive cost is down 25%.

. . . Airplane governor steel ball swivels, maker claims a 50% increase in production, thereby opening a shop bottleneck.

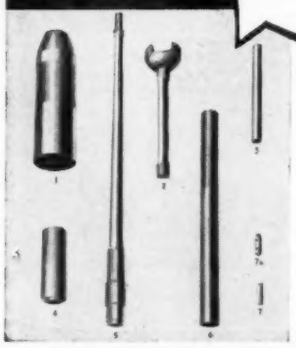
. . . Plant producing machine gun parts boosted output 25 to 55 pieces per eight-hour shift.

. . . The major advantage claimed is reducing the polishing cost per piece by increasing the production rate.



Showing patented pressure roll with abrasive belts leading to backstand.

HERE ARE A FEW OF MANY PARTS FINISHED ON THE HAMMOND "OD" CYLINDRICAL FINISHING MACHINES



FOR 1/4" TO 9" OUTSIDE DIAMETERS

The Hammond "OD" (outside diameter) Cylindrical Finishing Machine, using for the polishing member various types of wheels or abrasive belts with backstand to finish the work, is the best means of higher production for you. Flexibility of the machine is controlled by special fixtures and adapters, designed and engineered by Hammond. If you have a problem in cylindrical shapes, send samples of pieces on which a finish is desired together with a finished piece for a complete engineering report. Do it today, don't delay!

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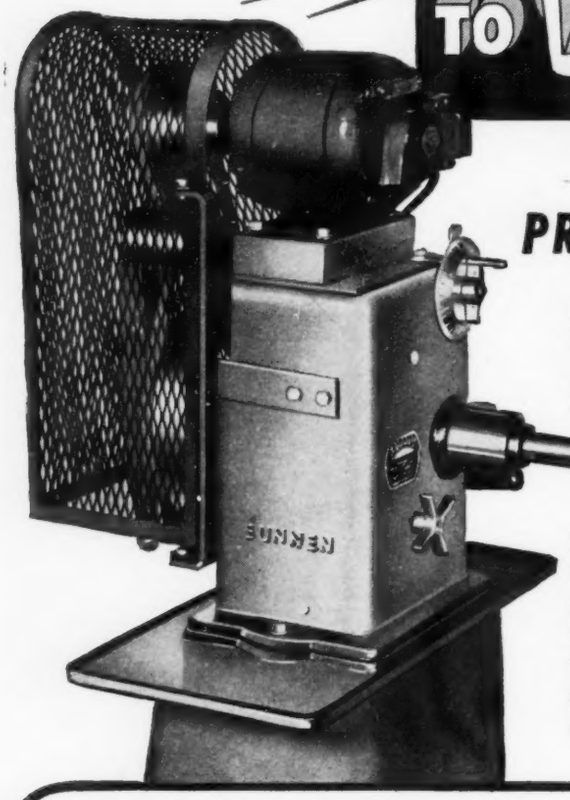


With THE SUNNEN PRECISION HONING MACHINE

SPEED **to meet today's ever-increasing demand for vital implements of mechanized war.**

ACCURACY **to insure fewer rejects and absolute interchangeability of parts. Super-smooth finish.**

LOW COST **— Both initial and operating.**

WIDE RANGE **— Handles any internal diameter from .185" to 2.400".**

EASY TO OPERATE **— Workers in "teens" — even girls — can be trained to do expert work in a few hours.**

CONSERVES **— Relieves big internal grinders for other jobs. No fixtures needed — work held in hand.**

These are only a few of the reasons why it will pay you to put Sunnen honing to work in *your* plant — as it has hundreds of leading manufacturers.

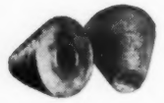
Aluminum Aircraft Link "produces high finish without bell-mouthing."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

"Strict alignment maintained between two holes."

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.



Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

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Hardened Steel Inner Bearing Race honed to .00005" limit. Surface finish improved; errors of out-of-roundness eliminated.

Drill Jig Bushing "Increases sales appeal of product."

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giving complete information or, if you prefer, a Sales Engineer will be glad to call with his demonstrator and show you what this machine can do on your job.

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Peerless Saws are Helping to Save—TIME...METAL...and BLADES

PEERLESS 14" High Duty Saw, cutting butt end from 155 mm semi-finished shells. As many as 800 pieces are cut with a single, high-speed, 4 tooth, $1.50 blade.

American tools and free Americans have created a miracle of mass war production . . . have set an impossible pace for Axis slaves to follow. To help these free men produce, Peerless has made practical the faster cutting of metal.

Faster cutting has been made practical with a Peerless — the Saw with the exclusive Four-Sided Saw-Frame, and Backing-Plate Blade-Support. Besides reducing CUTTING TIME; Peerless Saws save METAL, too. The thin, cool-running, straight-cutting blade removes as little as 1/16" of the stock.

BLADE SAVINGS also count up fast in triple-shift, high speed cutting. On a Peerless High Duty as many as 800 butt-end shell cuts are being made with a single blade.*

These savings in TIME . . . METAL . . . and BLADES are helping free men to win, and to buy their War Bonds every pay day. More complete details on this 3-way saving will be mailed at your request.

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Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-10-29-42, Racine, Wisconsin

*Mail complete details on the performance record shown above.....

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☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
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FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

"Blount" The NEW MODEL K

BUFFER and POLISHER

Speeds production through easy handling

This new Blount contribution provides offset wheel shafts and overhang toward operator, making it easy to work at. Plenty of room is available for swinging work to be polished. Fewer parts requiring attention assure easy operation; ample foot room reduces fatigue by enabling operator to stand erect at his work; streamlining simplifies cleaning.

Other features include:

. . . heavy rigid, smooth base construction.

. . . motor mounted in air-flow base; special enclosed or drip-proof motors not required.

. . . easily accessible and adjustable V-belt drive completely enclosed for maximum safety within column.

. . . spindle lock for holding spindle when changing wheels.

. . . positive grease-sealed bearing assemblies.

COMPLETE DETAILS AVAILABLE ON REQUEST

CONDENSED SPECIFICATIONS . . .

Height floor to spindle center—38"
Spindle length overall—53"
Spindle extension, each side—10¾" (optional)
Spindle bearings—Simplex "Cartridge-Type"
Spindle revolutions (optional)
Motors—2, 3 and 5 H.P.
Base 28" x 24"

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Since these parts can be made in many forms, machining is almost entirely eliminated with resultant savings in cost of manufacturing and scrap.

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THREAD SYSTEMS

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British Standard Whitworth * British Standard Fine Thread * British Association Thread * Cycle Engineers Institute Thread * British Standard Pipe—Taper and Straight * International Metric Thread * French Standard Metric Thread * French Standard Thread * Lowenherz Thread—Decimal Inch Equivalent of Millimeters * Equivalent of Metric Pitches in Inches and Threads Per Inch * Three Wire System of Measuring Threads * Decimal Equivalents * Single and Double Depths of American National Whitworth and V Threads Compared * Cutting Speeds—Surface Feet * Weight of Bar Stock Per Foot * Guide for the Design and Purchase of Screw Machine Products * SAE Steels (Analysis) * Comparison of British and American Nickel Alloy Steels.

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for Sharpening
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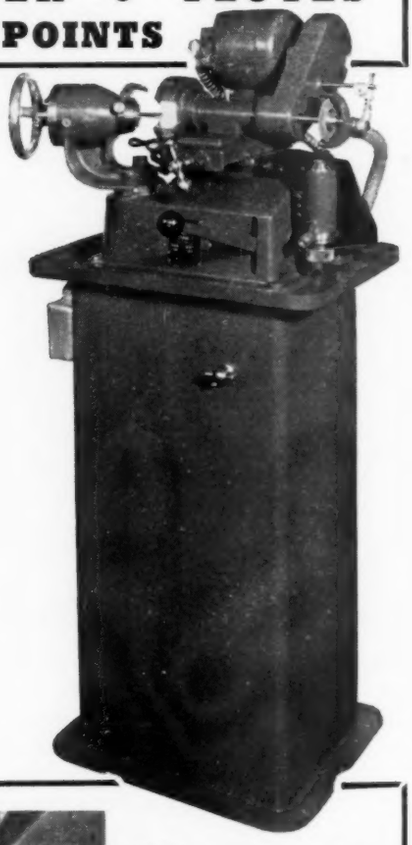

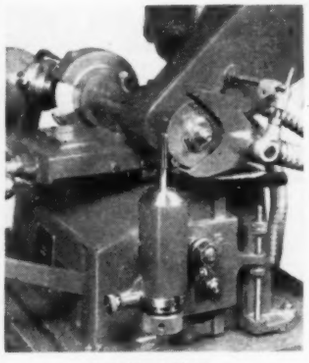

Grinding Flute

Grinding Spiral Point

● This compact machine features a belt driven grinding wheel spindle which permits the use of any type motor. You also have a choice of 3 sizes of chamfer and flute heads as follows—

#2 to ⅜" hand taps
#6 to 1" hand taps
¾ to 1½" hand taps

Combinations of any number of flutes—right or left hand.

ALL TAPS HELD BY SHANK

Taps can be sharpened after center is destroyed.

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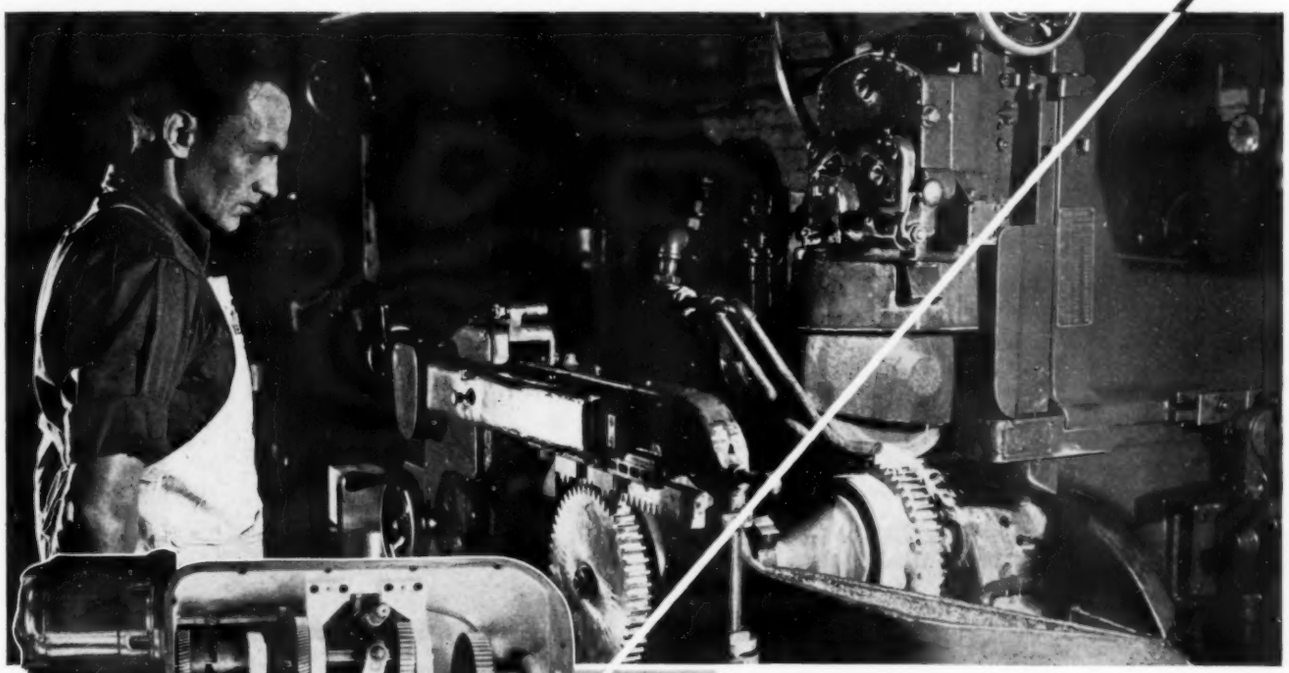
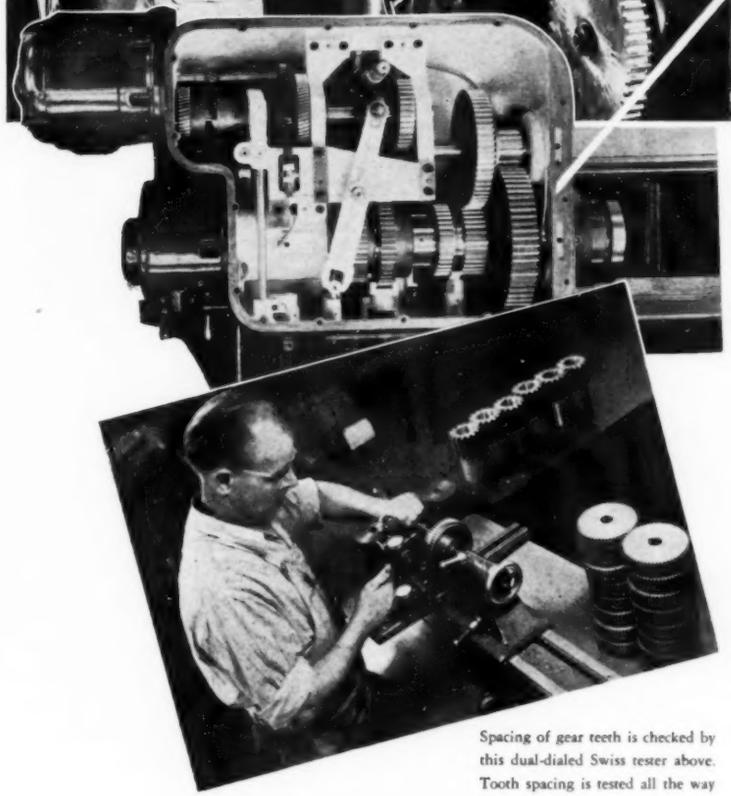
GEARED TO DO A *Good Job*

FOR TODAY...AND IN THE FUTURE





Spacing of gear teeth is checked by this dual-dialed Swiss tester above. Tooth spacing is tested all the way around the gear.

For twenty-five years Axelson Engineers have perfected the design and manufacturing operations that assure accuracy and precision of all Axelson Lathes.

Today the demand has multiplied and the production of Axelson Lathes has increased many times. Each one as it comes from the production line is as fine a machine tool as is possible to build. Every manufacturing step from the selection of raw materials to delivery is as carefully inspected and tested as ever. The engineering skill and craftsmanship of the men who build these fine machine tools has never been rationed.

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ARMY (E) NAVY

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28 helpful sections

Screw Threads
Pipe and Pipe Threads
Drilling
Reamers and Reaming
Taps and Tapping
Files and Work Benches
Babbitting, Brazing, Soldering and Welding
Gearing
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Milling Machine Feeds and Speeds
Grinding, Honing and Lapping
Screw Machine Tools, Speeds
Punch Press Tools
Broaches and Broaching
Bolts, Nuts and Screws
Measuring and Fitting
Tapers and Dovetails
Shop and Drawing Room Standards
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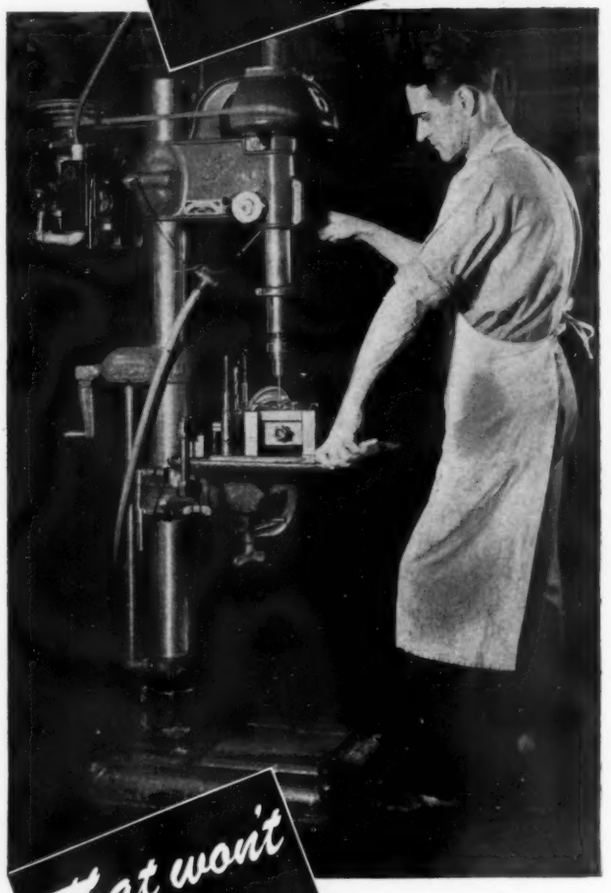
Company ..... A. 10-29-42

Here's a real FIGHTING TOOL



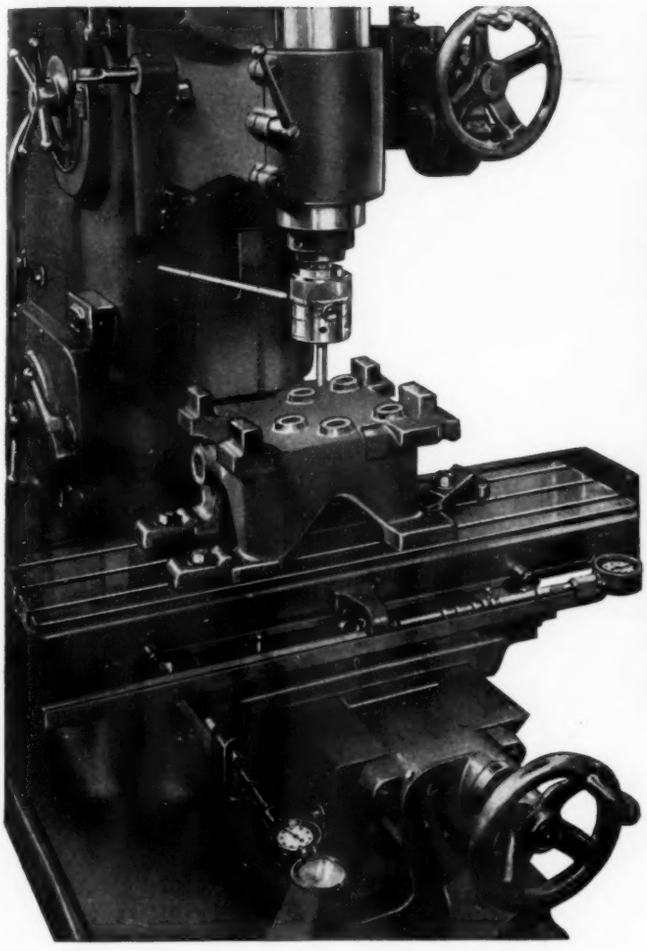
That won't give up...

● It obeys, too, the operator's slightest wish. That's because Buffalo Drills are designed for quick, precision control—easy control which insures more accurate work and speeded-up output. On the production line, in the precision workmanship of the tool rooms, Buffalo Drills are fighting side by side with our determined Industrial Army.

BUFFALO FORGE COMPANY
448 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd.
Kitchener, Ont.

"Buffalo" DRILLING MACHINES



A typical jig boring job is done on a KNIGHT Miller. With dial indicators, all five holes were accurately located and bored. At the same setting, the corner pads were milled, insuring squareness with the bored holes.

- Internal and external milling is done at one setting
- Step milling is made easy by getting vertical adjustment on spindle
- Profiling, boring, and slot-milling is all done at one setting
- Precision boring is done, using dial indicators for accurate locating
- Rigid spindle makes possible deep end milling
- Jig boring is possible because of dial indicators
- In experimental work you can machine many jobs completely on this one machine and handle difficult operations without special equipment
- For limited and special production you can keep costs down and maintain quality without special tooling

WRITE FOR NEW CATALOG

Wide Range

KNIGHT Millers ADD SPEED TO EACH SHIFT'S PRODUCTION···

KNIGHT VERSATILE ACCURATE RIGID

Large work or small—milling or boring, roughing, or accurate finishing cuts—all are handled to equal advantage on this wide range machine. Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

Greater speed is realized by users of KNIGHT Millers because of (1) the short time required to make set-ups, particularly difficult ones (2) the elimination of additional set-ups or at least the simplification of them (3) the quick and accurate location of holes and surfaces, especially when dial indicators are used (4) the quick change of vertical settings by moving the spindle instead of the work (5) the fast method of changing cutting tools (6) the swiveling table which greatly reduces the most expensive element in tool room operation—that of time waste in set-up work.

●

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

HIGHLY EFFICIENT IN ACTION!

NICHOLS Hand Miller

Built to keep pace with "around the clock" production, the NICHOLS HAND MILLER combines time-saving efficiency with high cutting speeds in the precision milling of small parts.

Low cost investment in the NICHOLS HAND MILLER will pay high dividends on your production line where speed with accuracy is essential.

Longitudinal Feed, 10". Transverse Feed, 7". Vertical Feed of Knee, 13½". Vertical movement of Head, 4½". Micrometer dials on Transverse and Vertical Feeds. Spindle Speeds:—100, 200, 600 and 1200 r. p. m.

W. H. NICHOLS & SONS

WALTHAM, MASS., U. S. A.

Buhr **DRILL HEADS SIMILAR TO THIS ONE,**

ARE SPEEDING PRODUCTION IN VITAL WAR PLANTS

Here is but one example of the specialized engineering incorporated in BUHR-designed drill heads, now being used in the production of aircraft and armament. Want similar applications, so as to speed your work? Then send us your blueprints . . . . we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.

Sixteen-spindle Buhr Drilling, Counterboring, Facing and Reaming Head, designed for the left-hand head of a 2-way Machine. Vertical adjustment. Two top spindles are accelerated to give three times the feed of the other spindles. Oil pump provides positive lubrication.

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICH.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

2-Spindle, Hydraulic Valve Clearance Mill for Aircraft Pistons . . . Triples Production

43915

Tripled production and improved cutting technique are the accomplishments of this special machine, designed and built by Snyder for milling valve clearance pockets in aircraft engine pistons.

Two-way type sliding spindle housings are synchronized to a standard, electrically powered, Snyder 3-station Geneva index table. The piston is positioned manually with a pin engaging the wrist-pin holes of the piston and is clamped by means of simple cam action in the fixture.

The work cycle consists of an index, followed automatically by the infeed of the cutters into the work. While one piston is being loaded, the other two are receiving their successive cuts. The cycle is semi-automatic so that after manual clamping, an electric starter button must be pressed for each work cycle.

The use of the standard Snyder 3-station Geneva index table as the basis of the automatic cycle mechanism is typical of how Snyder standard assemblies are used to expedite the output of special machines to solve today's production problems.

If production is *your* problem, we invite your inquiries.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for **HIGH** *production at* **LOW** *unit cost*

IMPROVED

CEMENTED CARBIDES

IMPREGNABLY BONDED TO

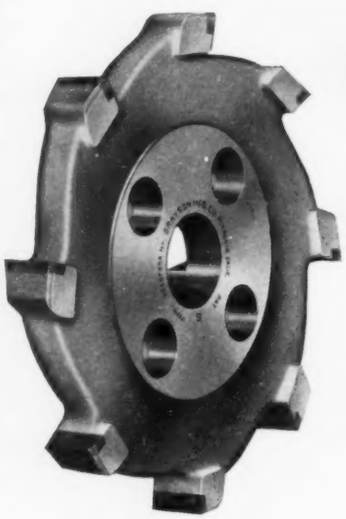
MEEHANITE

HAVE MADE POSSIBLE

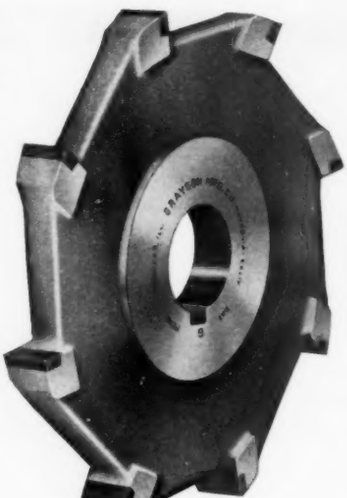
A NEW ERA

IN THE ART OF

METAL MILLING



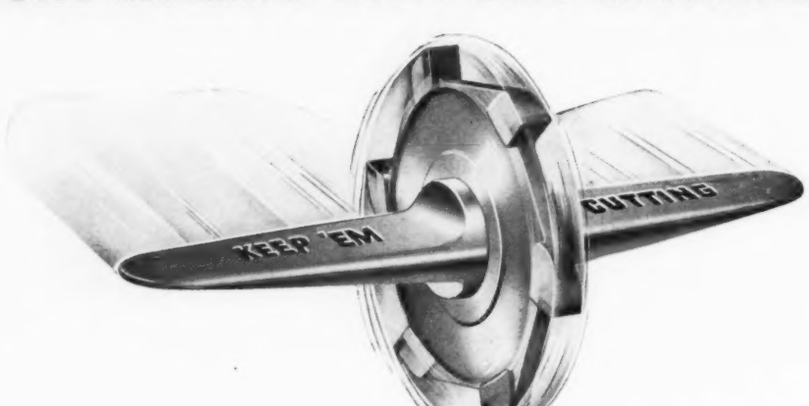
FACE MILL



SIDE MILL

MORE MILLING WITH LESS MACHINES

HARD and TOUGH developed FOR INTERRUPTED CUTS



Equally Good for CHILLED CAST IRON or ARMOR PLATE

Vibration and Chatter are reduced, instead of Amplified,
Due to the rare damping Qualities of

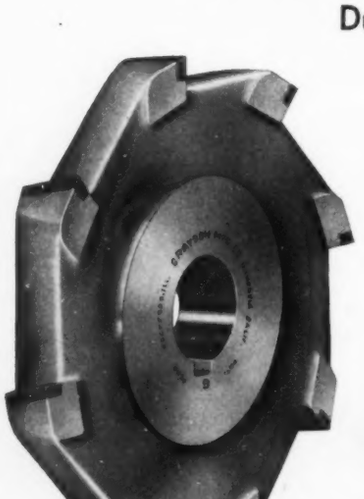
MEEHANITE

DOUBLE ***SPEED PRODUCTION***

500% MORE PARTS PER GRINDING

PATENTS PENDING

THE FULL STORY ON REQUEST



HALF SIDE MILL

GRAYSON

MANUFACTURING CO.

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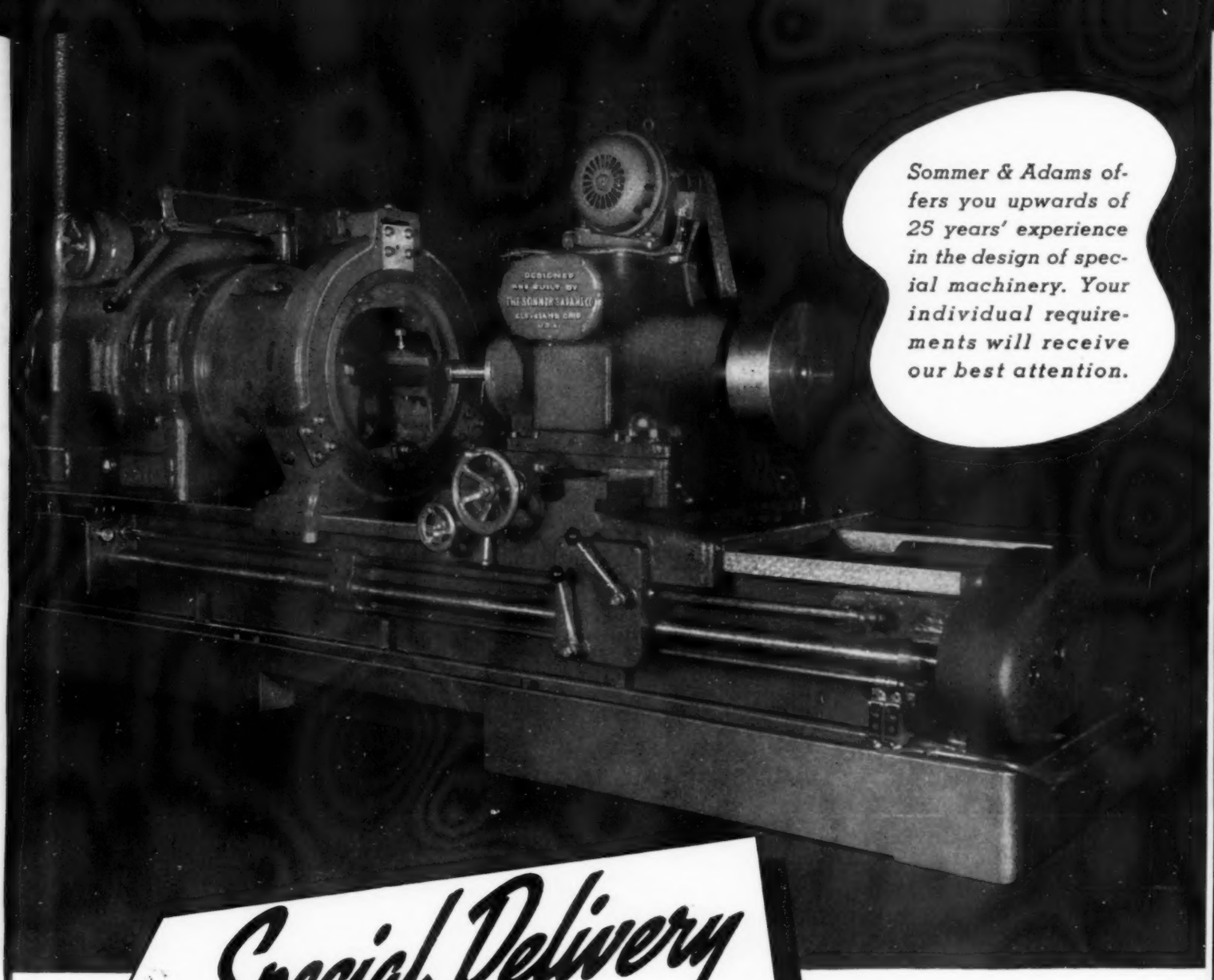
ROCKFORD, ILL. TALCOTT BLDG.

STAGGERED TOOTH SIDE MILL



Sommer & Adams offers you upwards of 25 years' experience in the design of special machinery. Your individual requirements will receive our best attention.

Special Delivery FROM SOMMER & ADAMS

THE huge machine you see above is 14 feet long, 5 feet wide, and 6-1/2 feet high. *From end to end, it was a special job.* Its purpose is to mill the thread in the tubes and breech rings of 90-millimeter and 4.7-inch guns. It is the hope of The Sommer & Adams Company that the good results which will be achieved from the use of this equipment may contribute in some degree to ultimate victory.

* * *

Illustration shows machine arranged for milling threads in breech rings.

Resolve to invest at least 10 percent of your income in your country's future. Buy war bonds

THE SOMMER & ADAMS COMPANY

18511 EUCLID AVENUE • CLEVELAND, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES

early delivery

MOREY 8" VERTICAL SHAPER

EQUALLY EFFICIENT IN YOUR TOOL ROOM OR MANUFACTURING DEPARTMENT

features

Precision . . . Easily handled—your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control . . .

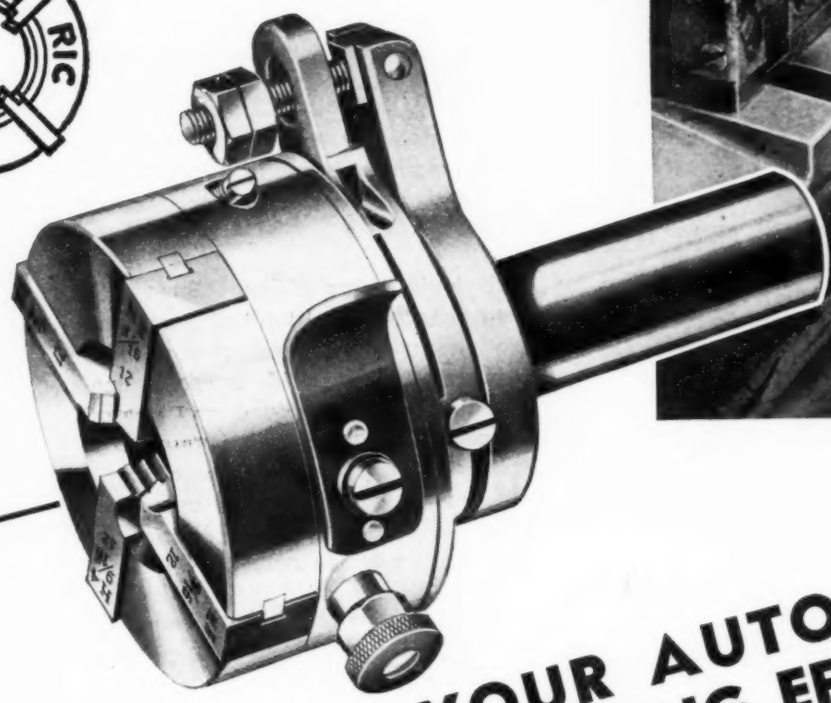
Also built in 12" and 14" sizes

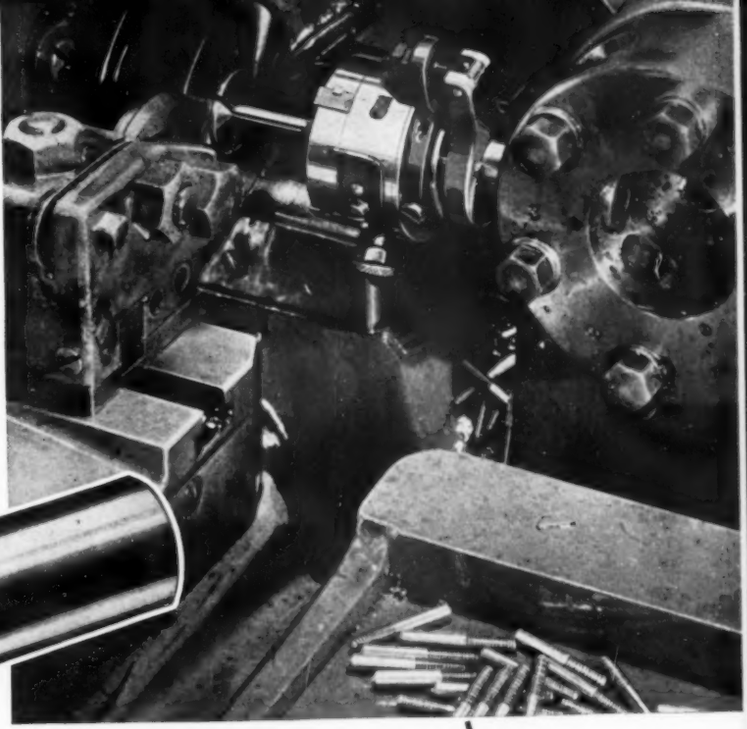
DESIGNED AND BUILT BY **MOREY MACHINERY CO., INC.**

Ask for Circular No. 726

410 BROOME STREET NEW YORK, N.Y.

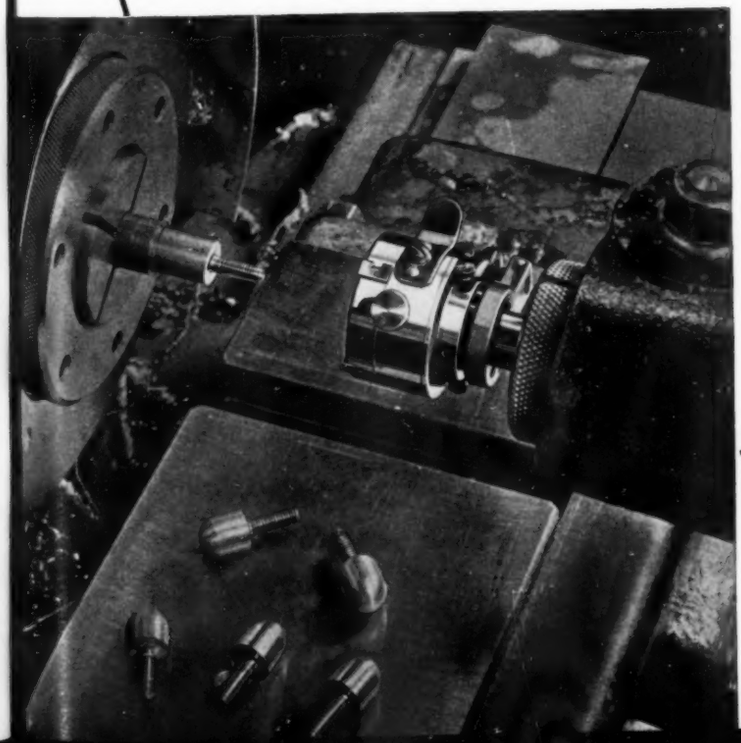
STYLE DS





. . . GIVES YOUR AUTOMATICS MAXIMUM THREADING EFFICIENCY

The two aircraft threading jobs shown illustrate how Geometric Style DS Die Heads are enabling manufacturers to combine the high production possibilities of automatic machine operation with the precision results that are imperative on aircraft work. Designed especially for use on Brown & Sharpe Automatics and similar machines. Style DS Die Heads—and all the other tools of the complete Geometric line—have these fine tool features: Every major part made of special alloy steel, hardened and tempered all the way through . . . Quick, easy, accurate chaser adjustment; rigid chaser support . . . Easy shoulder threading with regular chasers . . . All working parts fully protected . . . All Die Head chasers checked—and rechecked in actual use—for thread form, lead, taper and hardness.



THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

GEOMETRIC

CLEVELAND *Open Side* PLANERS

"NEW SERIES"

for increased production on war contracts

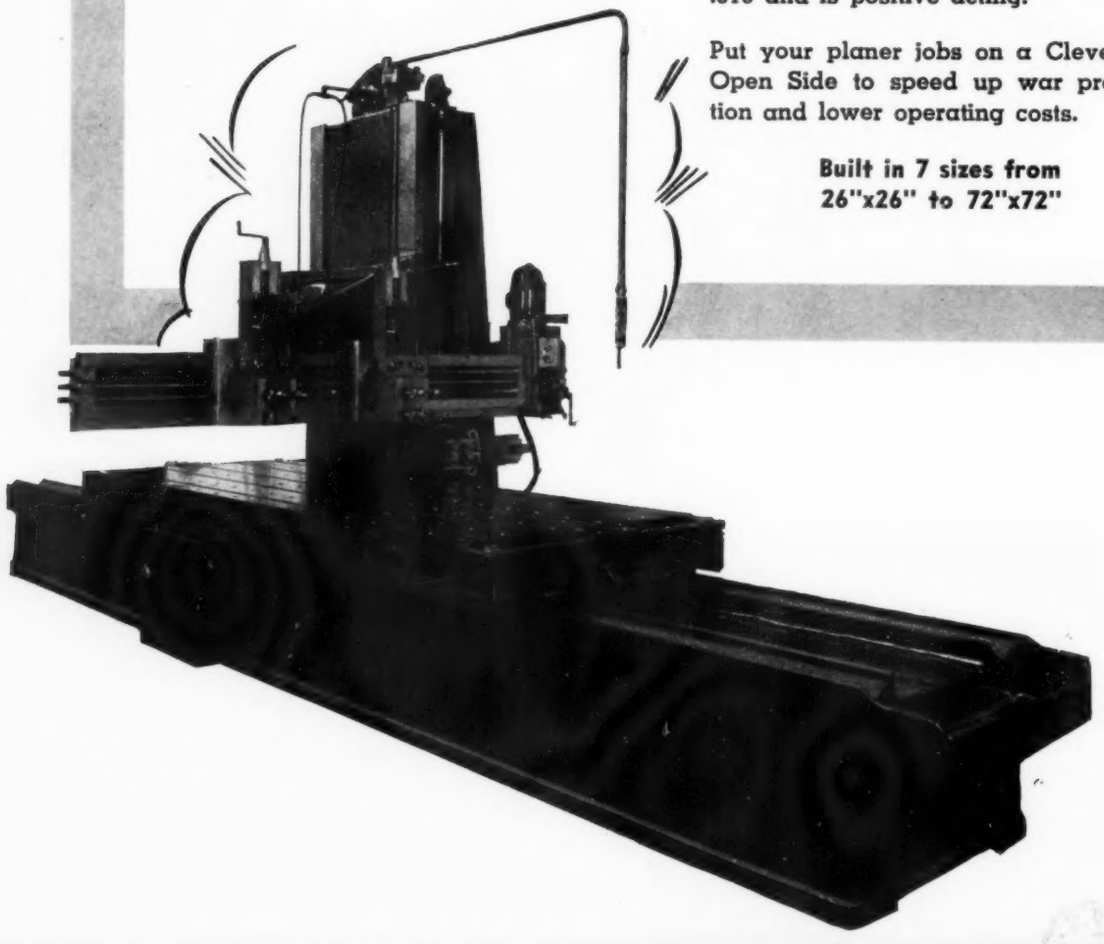
● The need for more and more guns, tanks, planes and equipment for widely scattered fronts increases daily.

The "NEW SERIES" Cleveland Open Side Planers are working on round the clock schedules in many plants speeding vital equipment for our armed forces.

Such features as Column Base cast integral with closed top bed, improved head design to give greater rigidity, newly designed rapid traverse, centralization of feed, speed and operating controls—all help to increase production — maintain close accuracy — and provide easier, quicker operation. Dial feed ranges from 0 to 1 inch by .010 and is positive acting.

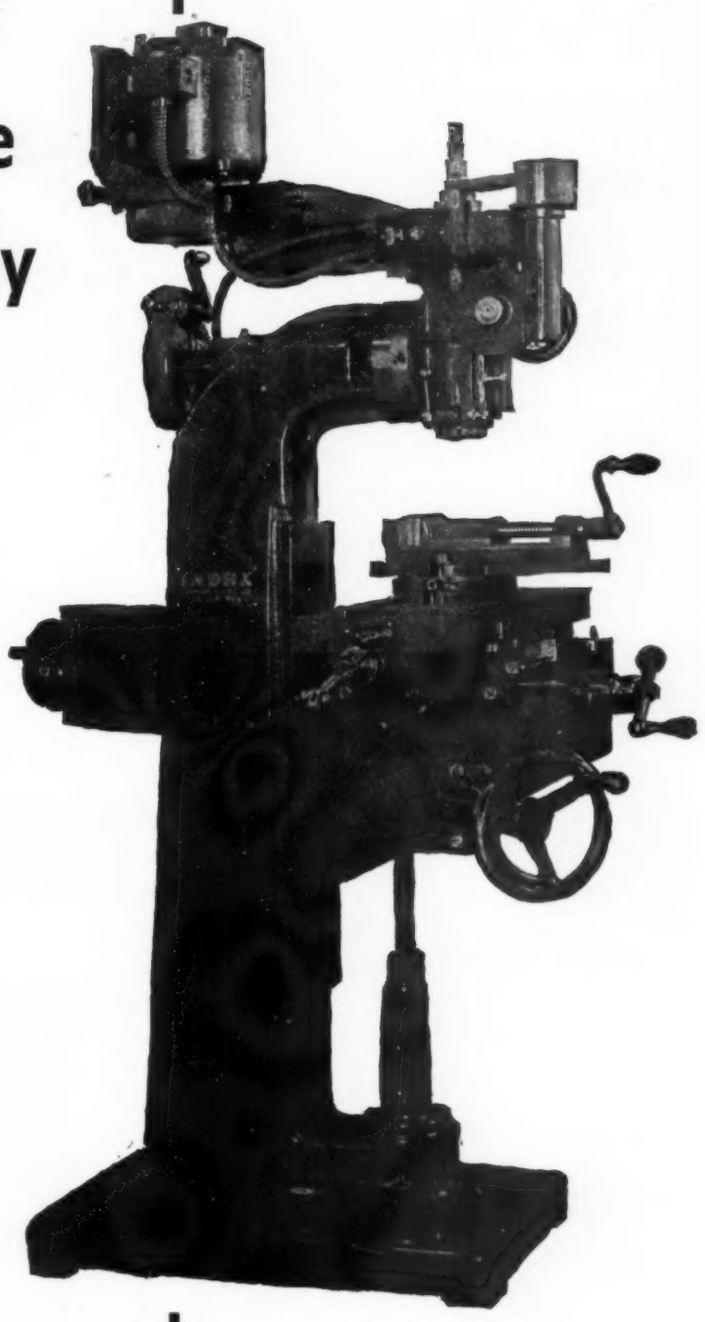
Put your planer jobs on a Cleveland Open Side to speed up war production and lower operating costs.

Built in 7 sizes from 26"x26" to 72"x72"



THE CLEVELAND PLANER
3148-3156 SUPERIOR AVE., CLEVELAND, OHIO

A Simple and Practical Machine For Approximately $1000.00



That was the original idea of the Index Machine & Tool Company in bringing out the 40-H INDEX.

Rugged and fast for its class. Designed to do end mill work with end mills from ⅛" to ⅝" in tool steel. With a spindle running in super precision pre-loaded ball bearings . . . with verniers for locating . . . with power feed to spindle for boring.

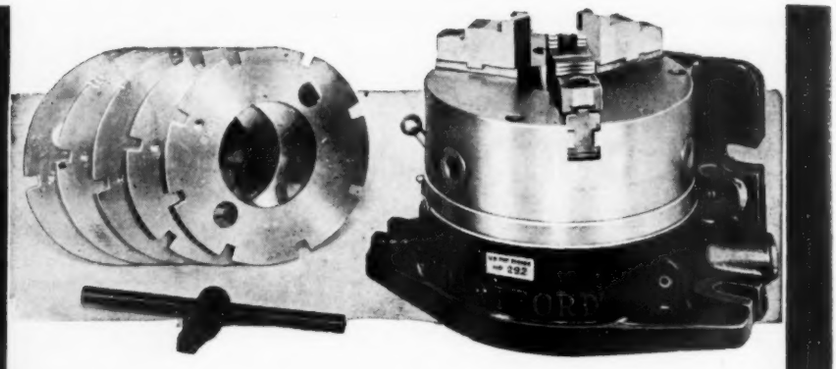
This has now long been an accomplishment, TRIED & PROVEN by hundreds of Defense Plants on parts for all kinds of war equipment from binoculars to battle ships.

If you do not know about this machine you should write at once for full particulars from

BLANK & BUXTON MACHINERY CO.

3100 E. MICHIGAN AVE. • JACKSON, MICH.

RAPID, POSITIVE, ACCURATE INDEXING *with the* HARTFORD SUPER-SPACER *assures* FASTER PRODUCTION



Whether used for single piece work or quantity production, the HARTFORD SUPER-SPACER is a tool of outstanding value for the rigid control of accurate machining operations. With its attachments and fixtures it is adaptable to milling, drilling, grinding, jig boring and slotting and can be used under speeds and feeds limited only by the capacity of the holding means and the power of the machine. Heavy cuts do not impair its accuracy. All chance of error is eliminated by mask plates.

The HARTFORD SUPER-SPACER is simple, compact and rugged in design and is substantially and precisely constructed. It can be operated in either a vertical or horizontal position depending on the nature of work it is to handle.

Consult our engineers for further details and suggestions as to how the "HARTFORD" may be used to improve your specific operations.

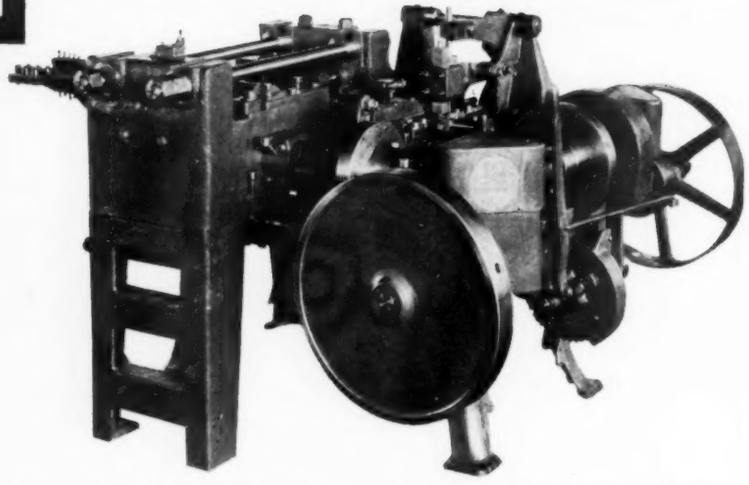
Ask for 8-Page Bulletin Showing Typical Applications

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD CONNECTICUT

The New **NILSON** **AUTOMATIC PRESS *and* FOUR SLIDE MACHINES**

for swaging, stamping, piercing, blanking, forming of coiled metal

These new machines built in two models—for general purpose, heavy duty fabricating metal forming—provides a capacity far beyond what is practical to accomplish with ordinary cam motion. The new NILSON is a combination power press and four slide machine with powerful silent action of main press slide operated by crank motion through toggle or knuckle joints. Great strength and rigidity are inherent in this machine. Die sets are readily accessible and easily removable. No obstruction to view is offered and tools can be adjusted without interference.



These machines are built in 2 sizes—for forming from 3/16" and ¼" diameter wire and for flat material 2" and 2½" wide. Send for 4-page bulletin giving complete details.

As specialists in the design and construction of special automatic machinery of all kinds, we are in position to render a complete service on this class of work. Consult Nilson on your special requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

PRESSUREMATIC CONTROL

IS HELPING AMERICA MAKE MORE

BULLETS

FASTER - BETTER - CHEAPER

Dies for .30, .45, and 50-caliber bullets are pressed out of water-hardening steel with speed and precision on the Pressurematic Electric Power Press. By pre-setting the pressure control gauge the nosing piece penetrates the die metal to the required depth. The automatic reversing action of the ram provides a simple means for stripping. Both downstroke and up-pull are constant, steady, **controlled!** Ideal for many extrusion jobs.

Exclusive Automatic Pressure Control

Pressure control gauges available are sensitive within 100 lb. units up to 60 tons. Ram stops when pre-set pressure is reached, or may be set to back off work any distance required and then come down again. Top efficiency for production pressing, assembling, or straightening operations.

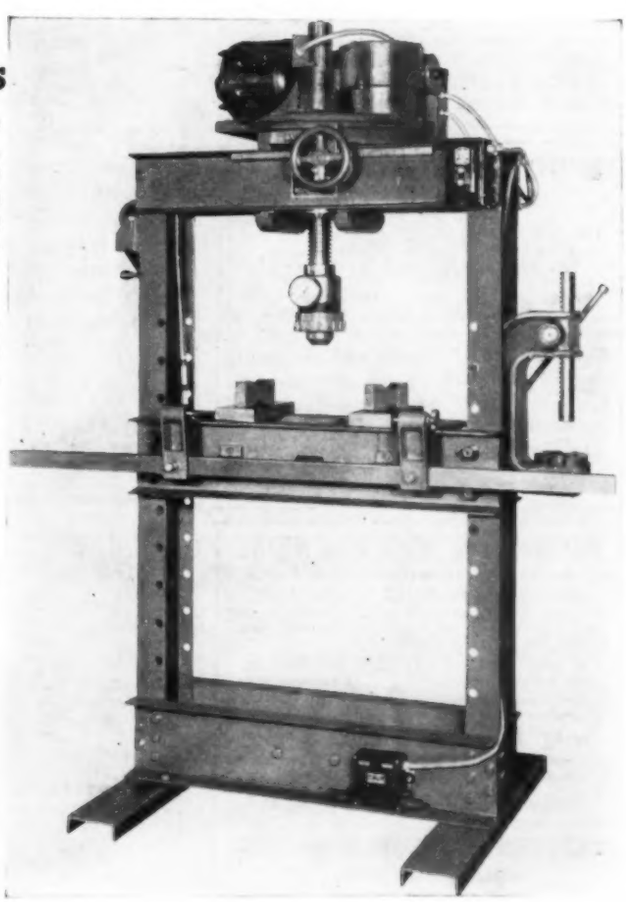
HYDRAULIC AND ELECTRIC PRESSES $215 TO $1398

SPECIFICATIONS

SERIES 300 *Electric* POWER PRESSES

Head Rail	7" Channel
Bolster	9" Channel
Base Rail	9" Channel
Side Column	7" I Beam
Width between columns	36¾"
Overall width	44½"
Width between bolster	7"
Ram Speed (Inches per Min.)	3 to 12½
Ram Travel (Standard)	9¼"
(Travel up to 14" available at extra cost.)	

Pressures	40 or 60 Tons
Motor	1½ H. P.
Phase	1 or 3
Frequency (cycles)	50 or 60
Voltage	220 AC
Maximum bolster travel	36"
Maximum height between floor bolster and ram nose	54½"
Top of frame from floor	75¾"
Height clearance required	97"
Shipping weight (without any attachments of fixtures)	approximately 1700 lb



Prompt Delivery!

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PRODUCTS INCORPORATED
BEDFORD, OHIO • U S A

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

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Engineers . . . Manufacturers
Sub-contract facilities for die castings and metal stampings
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METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
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GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES
BARTON MACHINE & TOOL CO.
PRECISION TOOL MAKERS
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MACHINE SHOP WANTS DEFENSE WORK
Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.
STEPHEN J. LEWIS ENGINEERING CO.
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COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
AGERSTRAND CORPORATION
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BRAZING HYDROGEN ELECTRIC FURNACE PROCESS
MODERN CONTINUOUS HIGH PRODUCTION EQUIPMENT
ALSO—BRIGHT ANNEALING
THE QUEEN CITY STEEL TREATING CO.
CINCINNATI, OHIO

WORK WANTED FOR
Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.
HAIDA ENGINEERING CO.
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SPUR GEAR AND SPROCKET CUTTING
Have three automatic machines available—range 1" to 6' diameter.
OHMSTEDE MACHINE WORKS
897-899 N. Main St. Beaumont, Texas

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.
KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.
GENERAL PATTERN WORKS
2233 Buck Street — Cincinnati, Ohio

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

OUTSIDE HELP WANTED

As America arms for defense, metal-working companies all over the country need outside help—help in meeting present production schedules, help in increasing production on regular products, and help in building special defense items. Busy shop and management executives are turning to American Machinist's CONTRACT WORK SECTION to locate this outside help quickly and directly. And when they do not find exactly what they want in the current issue, they write us like this:

> "Will you kindly advise us the names of established manufacturers who may be interested in manufacturing screw machine parts for us."
> —*From a Connecticut manufacturer*

> "We are about to have several machine tools built and would be obliged if you gave us the addresses of metal-working factories in the New York District, if possible with foundries . . . It is also a question of planing work . . ."
> —*From a New York concern*

THE OPPORTUNITY IS HERE

for all kinds of contract work. If you are interested in your share of metal-working contracts, short-circuit inquiries like these! Be sure your company is represented in *every issue* in American Machinist's CONTRACT WORK SECTION. Write for complete details *today!*

CONTRACT WORK DEPARTMENT • AMERICAN MACHINIST
330 W. 42d St., New York

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples *today* for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

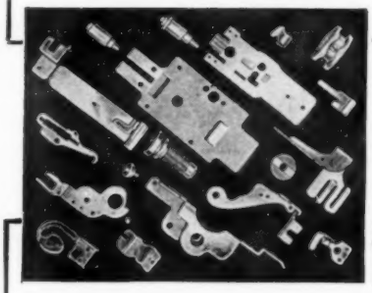
Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

STAMPINGS AND ASSEMBLIES

Fast Service on Long or Short Runs



"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy
SPECIAL MACHINERY
CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

QUALITY

SCREW MACHINE PRODUCTS

• • •

WALTHAM SCREW COMPANY
WALTHAM • MASS.

STEEL FORGINGS

On Trip Hammers and Forging Rolls. Also all kinds of light, medium, and heavy hand forgings. Machining. Heat Treating.

Vince Forging & Manufacturing Co., Inc.
518 East 20th Street New York City

Designers and Builders of Jigs, Fixtures and Small Tools.

Also Manufacturers of Automatic Turret Head for 10 inch Lathes.

Complete Details upon Request

GAS MODEL RESEARCH CO.
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MACHINISTS AND ENGINEERS
FIDELITY MACHINE COMPANY
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Jefferson 7600-1-2

PUNCHINGS STAMPINGS ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today!* Send prints or samples.

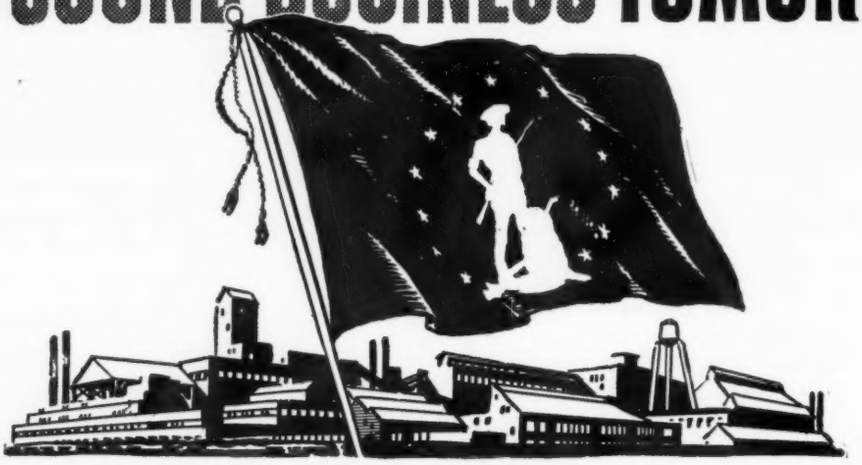
M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

DESIGNERS OF
Jigs, Fixtures & Dies

Prompt Service

LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria Virginia

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW



Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

Save With

War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns — 30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., November 2nd will appear in the issue of November 12th, subject to limitations of space available

POSITIONS VACANT

PROJECT ENGINEER—To fill position covering engineering contacts, experimental development work, and miscellaneous mechanical and electrical accessories in the aircraft field. Engineering school and practical experience background. Must have draft deferment and not presently employed in war industry. Titeflex Metal Hose Co., 500 Frelinghuysen Avenue, Newark, N. J.

PRODUCTION MANAGER. For Eastern die casting plant. Must have die casting experience and ability to take full charge and supervise production methods and personnel. The man who can get results from this plant, will receive adequate compensation. Reply fully stating experience and salary expected. Box 2444, 1457 Broadway, Suite 617, NYC.

Assistant General Foreman wanted

for scraping, fitting, assembling departments. Machine Tool Plant. Preferably under 45 years of age. Must be capable of directing work, know how to handle men, and be qualified to introduce improvements. Location New Jersey. State Qualifications, Nationality, salary expected in first letter.

P-317, American Machinist
330 West 42nd St., New York City

EXECUTIVE

With manuacturing and sales background
IN BALL BEARING INDUSTRY
by large nationally known metal manufacturing company. Attractive salary; excellent future for man with successful record. Write fully.

P-341, American Machinist
330 West 42nd St., New York, N. Y.

DESIGNER

For Jigs & Fixtures

machine tool manufacturer, location NYC. State experience, draft status.

Box #22, 1457 Bway., Suite 617, NYC

DRAFTSMEN-ENGINEERS

preferably with machine tool experience, able to design and detail machines and parts made to close tolerances. Location NYC.

Box #23, 1457 Bway., Suite 617, NYC

WHEN *Answering Advertisements*

PLEASE *do not send original letters, certificates or photographs. We cannot be responsible for their return. Please send photostat or carbon copies.*

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

Manufacturing Executives and Technical Men, chemists and metallurgists immediate openings throughout country. Salaries $2500 to $20,000 year. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson, Chicago.

EMPLOYMENT AGENCY

ENGINEERS—Fine selection of positions open for Manufacturing executives, Production Managers, Superintendents, Foremen, Metallurgists, Chemists, Instrument men, Technical men of all types. The Engineering Agency, Inc., Our 50th year, 53 W. Jackson Blvd., Chicago.

POSITIONS WANTED

EXECUTIVE with twenty-five years experience as Chief Engineer, Superintendent and Works Manager. Well versed on modern methods and equipment. Available October 1st. PW-308, American Machinist, 330 W. 42nd St., New York, N. Y.

PERSONNEL DIRECTOR—15 years supervising Labor Relations, Employment, Medical, Safety. Can make job analysis for rate studies. Good knowledge of labor laws. Experienced in automotive, radio, aviation and heavy machining industry. Can completely organize Personnel Department. Will go any place, west or middlewest preferred. PW-342, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" send without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on page Facing inside back cover.

MACHINERY SALESMEN
IS YOUR PRODUCT FROZEN?

If so, and you are beyond draft age, old established national concern will train you to sell and service chemical products to war industries. If interested send details, experience, age, salary expected.

SW-340, American Machinist
520 No. Michigan Ave., Chicago, Ill.

FOR SALE
PATTERNS AND DETAIL DRAWINGS OF Surface Grinder

7" x 20" Mechanical Feed Excello Spindle. Sample machine has been operating successfully for two years in plant production.

BO-320, AMERICAN MACHINIST
330 W. 42nd St., New York, N. Y.

WANTED

DRILL AND LATHE WANTED

One rebuilt or good used five foot Radial Drill 13" or 15" column; also one 16" to 20" Toolroom Engine Lathe with taper and backoff attachment 8 ft. to 12 ft. bed. State make, model, year, condition, price and shipping point.

M & H Valve & Fittings Company
Anniston, Alabama

WANTED

1—No. 16 Blanchard Grinder with 220-440 volt, 3 phase, 60 cycle motors on spindle.

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road Rochester, N. Y.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

PROFESSIONAL SERVICE

MORRIS AND VAN WORMER
Est. 1924
Industrial Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

AUTOMATICS

14"x19" Fay
No. 6A Potter & Johnston
Nos. 33, 34 and 454 New Britain
4½" Gridley model H
6"x6¾" Goss & DeLeeuw
1" Cleveland "J" double end
No. 16 Gisholt simplimatics
10" Bullard "Vert-al-Matic"

BROACHES

Nos. 1, 3 and 4 LaPoint screw
No. 3 LaPoint double screw
No. 2 Standard screw press
2 ton American rack vertical

DRILLS

15", 20", 21" Buffalo
20", 22½" and 26" Barnes
21" and 25" Superior
20", No. 210 Barnes heavy
24" Barnes all geared
20" No. 23 Foote Burt
21" Cincinnati manufacturing
Natco multiple Nos. 11, 12, B12, C12, 14 and 32, 8 to 62 spindles
No. 1 Baush multiple
No. 13 Pratt & Whitney multiple
Nos. 15½D and 15½F Foote Burt manufacturing
No. 8H Natco hydraulic horizontal multiple
Barnes vert. mult. hydr.
8 spindle No. 6 Moline Holehog
Nos. 0 and 00 Garvin duplex
4"x10" Sundstrand centerer
4' Hammond radial
Sensitive drills. Almost all makes and sizes

FORGING & STRUCTURAL

1½" Acme upsetters
2½" and 4" Ajax upsetters
2" National upsetter
No. 1A Ajax forging rolls
No. 4 Torrington swager
No. 6HS Langelier swager
60 lb. Bradley helve hammer
150 lb. Nazel air hammer
No. 1 Rock River bulldozer
No. 29 Williams White bulldozer
12", 1¼"x1" Cleveland horizontal punch
12", 1¼"x1" Long & Alstatter punch
26", ¾"x¾" Rock River punch

GEAR MACHINERY

Nos. 3 & 12 Barber Colman
No. 18 H Gould & Eberhardt
Nos. 1 & 5A Lees Bradner
26"x48" Brown & Sharpe automatic
30" Flather automatic
36" Gould & Eberhardt automatic
60" Cincinnati automatic
Nos. 6, 61 & 62 Fellows shapers
18" Gleason testers & lappers
15" Gleason spiral gear rougers
Gleason spiral pinion rougher
18" Gleason bevel generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

GRINDERS

10x36 x 10x50 Norton
12x36 Landis
12x36 Cincinnati
Capitol internal
Nos. 6 & 15A Bryant internal
12"x36" Diamond surface
20"x50" Safety surface
Nos. 50 & 60 Heald cylinder
18", 24" & 53" Gardner disc
24", No. 84 Gardner opposed disc
17"x36"-48" Norton hydraulic crankshaft
Gisholt tool grinder
24" Ingersoll tub type
30" Ransom elect. snagging
16" Norton snagging
2¼" Wil. & Morman drill
Type 15 Norton lapper
No. 575 Hawes tub polisher
20" & 36 Wet Tool

LATHES, TURRET

28" Steinle, 8" hole
24" Steinle 6¼" hole
22" Steinle, 3 9/16" hole
22" Libby, 4½" hole
2¼x24 & 3"x36" Jones & Lamson
Double spindle Jones & Lamson
14"x6' Lodge & Shipley with turret
No. 2 Acme
No. 2 Southworth
No. 2 Warner & Swasey

LATHES, MFG.

11"x3' South Bend, CCG
13"x20" Seneca Falls "Short Cut"
13"x6' Automatic threading
20"x8'6" Wickes mfg.
Melling camshaft
Melling crankshaft
28"x9' centers Bridgeford axle
3½"36" Le Swing

MILLS, BORING

3¾" bar Beeman & Smith horiz.
4-15/16" bar Barrett cylinder boring
36" Niles vert. car wheel borer

MILLING MACHINES

No. 3 Turnmilling for round work
Nos. 1 & 1A Davis & Thompson drum type duplex
48" Oesterlein tilted offset
Nos. 10 & 45 Productomatic
No. 6 Whitney hand
12" Pratt & Whitney automatic
Model AB Becker vertical

PLANERS & SHAPERS

24"x24"x5' Gray
24"x24"x6' Woodward & Powell
20"x20"x6' New Haven
36" Morton draw cut shaper
12" Dill vert. shaper or slotter

PRESSES

No. 5 Bliss Consolidated OBI
No. 5½ Niagara OBI
Nos. P2 & PA3 Ferracute
Nos. 14½ & 41A Toledo horning
Nos. 6 & 6½ Wat. Ferrel gap
No. 76 Toledo gap frame
No. 62 Bliss gap frame
No. 28½ Bliss straight side
No. 53 Toledo straight side
No. 8-7 Zeh & Hahnemann S.S.
No. 7 Rockford straight side
No. 4 Massillion straight side
No. 2 Standard screw type
28", No. 71 Swaine dbl. cr.
No. 6A Bliss cam drawing
No. 180 Toledo toggle drawing
No. 796¼ Toledo double crank toggle drawing, 108" bet. upr.
750 ton Baldwin Southwark triple action hydraulic toggle, 142½" between uprights

RIVETERS

Nos. 3A, 4A, 5½B & 7B High Speed
No. 80 Grant
20 ton Allen pneumatic

SHEET METAL TOOLS

4'x3/16" Cincinnati press brake
12'x10 ga. Ohl press brake
4'x3/16" Bay City band roll
No. 352 Toledo band roll
Nos. 1 & 2M Pettingell hammers
⅜"x3' and 5' Shuster wire straightt-ener & cutter
Sleeper & Hartley casing coiler
No. 5 Sleeper & Hartley spring coiler
No. 3 RH Magee Wirer

SHEARS

No. O-15 Stanley Uni-Shear
No. 225 A Bliss slitter
18" Pels beam
2" Newbold guillotine
1½" Lewis alligator
2" Hilles & Jones alligator

TAPPERS

⅝" National precision nut
Nos. 1 & 2X Garvin
Natco lead screw, 1 & 2 way
1½" National 6 spindle nut

THREADERS

¼"x3" Wat. Farrel thread roller
½" Acme double head
¾" Economy
1½" Geometric
2" Landis double
2" Landis pipe & Nipple
2" Rogaco pipe mach.

MILES MACHINERY COMPANY, Saginaw, Mich.

LATHES

16" x 10' Monarch Cone Drive, Q.C.
18" x 6' American Grd. Hd. 8 speed M.D. Turret on shear Q.C.
14" x 8' L & S Patent Head Lathe, M.D. Q.C.
26" x 14' Putnam Engine Lathe, Cone Head, Q.C.
40" x 20' McCabe Lathe, Cone Drive, Trip, Grd.
56" x 18' Putnam Turning Lathe, Belt feed.

GRINDERS

16" x 60" Modern Plain Grinder.
16" x 72" Landis Plain Grinder, Self contained.
Fitchburg Spline Shaft Grinder.

MILLERS

#1 P & W Hand Miller.
18" x 18" x 9' Beaman Slab Miller.

MACHINERY

18" Gleason Bevel Gear Generators.
6" Bilgram Bevel Gear Generator.
#00 Pfauter Gear Hobber.
#1 Adams Gear Hobber.
#1 Schucahrdt & Schutte Gear Hobbers.
Lees Bradner Gear Grinder.

MILLS

62" Colburn Vertical Boring Mill.
10' Pond Boring Mill.

PLANERS

32" x 32" x 18' Gray Planer, 2 Heads.
36" x 36" x 8' American Planer, 2 Heads.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

50 lb. Beaudry Hammer
40 lb. William Hammer
16"x32 Bridgeport Automatic Threading Lathe
10"x6" Higley Power Saw
24" Becker Brainard Automatic Gear Cutter for spur and bevel
Fisher Profile Grinder

INDUSTRIAL MACHINERY COMPANY
357 Dublin, Columbus, Ohio Adams 3534

OTT MACHINERY SPECIALS

AUTOMATICS, Cleveland, 1-1/16", Model A
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
AUTOMATICS, Cleveland ⅞ & 2⅛" Model B
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, Norton, 10 & 14x36" Plain
LATHE, Putnam, 60"x17' with 12" Riser Blocks
MILLING MACHINES, Craftsman # 1, 2 & 3
PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #2 to 6 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

1—6 x 8 Ott Grinder
1—No. 1 Garvin Tapper
1—D ngs Magnetic Separator, Type AD
1—No. 2 Baxemdale Punch Press, M.D.
1—No. 62 Bliss Punch Press, M.D.
1—No. 1A Wm. Sellers Tool Grinder
1—No. 3 Holmes Tilted Tapper
1—Universal Gear Tester
2—Toledo Electric Welders
1—Barr 4 Spindle Drill Press
1—No. 5 Farrell Bull Dozer
1—No. 5 Long & Allstater Punch Press

Your inquiries receive prompt attention

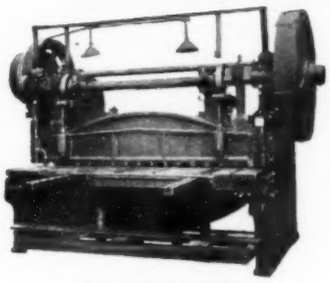
CENTRAL MACHINE TOOL CORPORATION
122-126 Nebraska Ave. Toledo, Ohio

WHEN Profit Margins are Small, Good Used Equipment—with its opportunity for saving—may meet many Urgent, Temporary or Permanent Equipment Needs.

If your need is special, immediate or economical, GOOD USED EQUIPMENT is worth investigating. Check the items listed in these pages for your requirements or write the Departmental Advertising Staff of this paper.

When You Need Machine Tools Check "FALK'S" Stock

"FALK" for DEPENDABILITY in Rebuilt Machinery



There is no occasion to gamble on the quality of the rebuilt machinery which you buy for plant extension, when taking on more War work.

Check "FALK'S" stock and have your experts examine the quality and mechanical condition of the machinery in our stock here ready for your immediate use.

"FALK'S" DEPENDABILITY is known to big users of machine tools throughout the Nation. If you don't see what you need here, listed on this page—write us and we will likely be able to meet your requirements.

MULTIPLE PUNCH

CINCINNATI 60" 100 Ton, Geared
THOMAS Spacing Machine, 42" wide now arranged for Plate shear 1¼"x42" cap. with Table
SHUSTER WIRE STRAIGHTENER AND CUTOFF. ¼"x10'

KEYSEATERS

#3½ BAKER—72"x3"
#1 LaPointe horiz. Broach
#4 LaPointe horiz. Broach
12" New Haven Slotter, Rotary Table

TURRET LATHES

#4 MILLHOLLAND-LASSITER, Staybolt Threader
21"x3½" hole, GISHOLT UNIVERSAL (2)
24"x5" hole; GISHOLT UNIVERSAL

AUTOMATICS

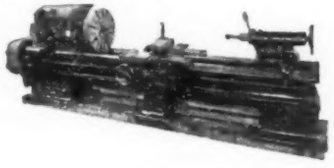
1¼ GRIDLEY Model "F" 4 spdle.
9/16 GRIDLEY Model "G" 4 spdle; (2)
#24 Prentice New Britain auto. Chucker
#23 Prentice New Britain auto. Chucker
12"x6" Jones & Lamson "Hartness" Chucker

IPE MACHINES

18" SAUNDERS, M.D.
12" MERRILL, M.D.
6" WILLIAMS, M.D.
4" CURTIS Portable, M.D.
2" LANDIS, belt
2" JARECKI, belt

LATHES

42x25' PUTNAM
36"x18' PRENTISS
27"x16' New Haven Heavy
24"x12' PUTNAM, QCG
24"x14' REED-PRENTICE Geared Hd.
22"x16' REED light pattern, cone
18"x10' Rahn-Larmon
19"x8' LeBlond Hvy. Duty, Pl. Turning
18"x6' South Bend
16"x6' South Bend
14"x6' Monarch Geared Hd.
14"x6" Hendey, Yoke Head
12"x5' Champion, Pl. cone
10"x4' Davis Pl. Chuge
10"x24" centers, LOGAN (new)



GRINDERS

GARDNER #14 double opposed Disc
RESLEY #6 double opposed Disc
GORTON 24" DISC and Ring Wheel
GARDNER #4 DISC 23", Ring Wheel 16" Universal Tables, belt dr.
CINCINNATI #2—12"x36" CYLINDRICAL, M.D.
SPRINGFIELD FACE GRINDER, 12" CUP WHEEL.
ROGERS 60" KNIFE GRINDER
FLOOR GRINDERS, B-LINE (NEW) 12x2 Wheels; 2 horse power, Ball Bearing; fully enclosed, adj. Wheel Guards, exhaust Takeoff, electric lights; Tool supports; in-built switch. $175 any voltage.

GEAR MACHINERY

GLEASON GEAR TESTER
WHITON #2 SPUR GEAR CUTTER, 36" cap.
BARBER-COLMAN #12 HOBBER
GOULD & EBERHART 36" Victoria Model
GOULD & EBERHART #36B, Spur and Bevel
ADAMS #1 Gear HOBBER
Van Norman Pinion Cutter, Small
Van Norman Pinion Cutter 3" cap.

DRILLS

SIPP-FOOTE-BURT 4 Spindle, power feed and quick return
Sipp—2 spindle #2 M.T.
AVEY 3 Spindle #2 M.T.
Avey 2 Spindle #2 M.T.
Leland-Gifford 2 spindle #2, 10" Overhang
ALLEN 2 spindle #2 M.T., Motorized
AVEY #3 single spindle Power feed, #3 M.T. 24"
AVEYMATIC single spindle with power feed; 20"
100 Spindles of High Speed sensitive, Ball Bearing Drill Presses made by Avey, Leland Gifford, Allen; Foote-Burt, Henry & Wright, Fosdick
New "BUFFALO" DRILLS—all sizes, many in stock

THREADING MACHINES

ACME 1" two Spindles, cone
Landis 1½" Two Spindles; cone dr.
NATIONAL 2" Two Spindles, Motor dr.
ACME 2½" Single Spindle, Cone Dr.
Landis 1½" Single Spindle, cone dr.

COMPRESSORS—AIR

12"x10" INGERSOLL RAND ERI with A.C. 50 H.P. Slip Ring Motor, etc.
10"x8" LAIDLAW, arr. Chain Motor Dr.
10x8x4 AMERICAN tandem Cyl. intercooler
8"x8" SULLIVAN Horiz. Belt dr.
6"x8" BURY Horiz. Belt Dr.
9"x8" BLAISDELL, horiz. belt dr.
4½x4½ CURTISS VERTICAL belt
6"x6" CURTISS TWIN CYL. VERTICAL

BUFFERS OR POLISHING LATHES

HAMMOND like new 10 HP type 10 PP 3-60-220/440 —8 months old

LOSWING LATHE

8"x108" Heavy Duty, Geared Head
4"x104" old model, Geared Head
4"x60" old model, Geared Head
4"x48" old model, Geared Head

THREAD MILLERS

LEES-BRADNER 12"x54"
HALL PLANETARY #2—24" swing

THREAD ROLLERS

WATERBURY-FARRELL #30, #10, #0 (2ea)
EYELETTING PRESSES #158 Waterburys

DIE CASTING MACHINES

MADISON-KIPP #5—10x12 & 12x14 late

RADIAL DRILLS

3' Arm AMERICAN, Geared Box, SPD.
5' Arm Niles, flat col. Motor dr.
5' Arm Niles, flat col. Motor dr.

PRESSES

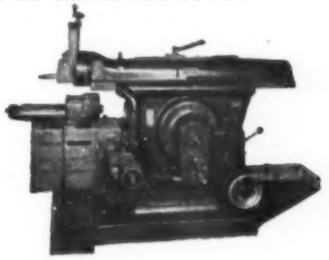
1—#35 NIAGARA Punch Deep Throat
2—#4 BLISS dble. crank
1—#5 BLISS dble. crank
#93F TOLEDO Dble Cr. Geared
#WFF Dble Cr. S.S. Geared, 70 ton
4" stroke; bed 30x26; 13" die space
#25N, #15N BLISS back flywheel
#2 Bliss Stiles type (10) also #1
#18—18C—#19—#19C—#20—BLISS, OBI
#25 NIAGARA ARCH; #30 Bliss Arch
#16 NIAGARA HORN, Geared, Motor Dr. with Table, elev. and swing, 5" st.
#44 V & O HORN, Geared; Table 24x24 2½" Str. Motor dr.
WICKES Dble End PUNCH & SHEAR; 48" thro. cap. 1¾ thru 1⅝
SOUTHWARK 520 Ton Hydraulic Press; with Lourie Pump, bed 30"x144"

MILLERS

INDEX UNIVERSAL VERTICAL (new)
CLEVELAND #1— cap 2" End mill (new)
BECKER #7 LINCOLN TYPE
MISC. CHICAGO AUTOMATIC THREADERS, BAKER AUTO. DRILLS; SLEEPER & HARTLEY AUTO. COILING MACHINES FOR MAKING SPEEDOMETER CABLE

SHAPERS

15" HENDEY Friction Dr.
30" STEPTOE, Back Geared, cone
30"x20"x24" PLANER-SHAPER; NBP



We try to maintain one of the leading stocks of Used Machinery.

SEND US YOUR INQUIRIES—EVERY ITEM FULLY GUARANTEED.

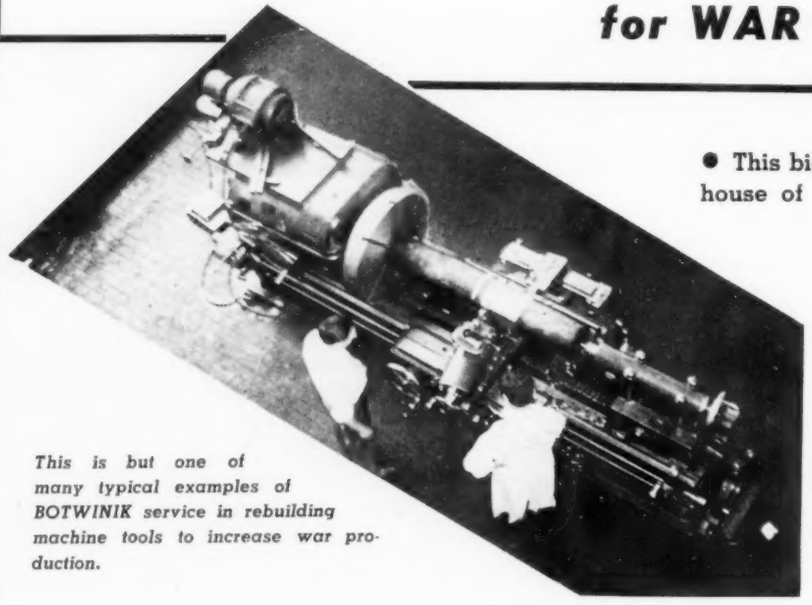
FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

BOTWINIK REBUILDS

for WAR PRODUCTION



This is but one of many typical examples of BOTWINIK service in rebuilding machine tools to increase war production.

● This big lathe was lying idle in the warehouse of a large manufacturing plant because it was not considered serviceable. However, it was shipped to the BOTWINIK plant, dismantled, and completely rebuilt. It was then returned to its owner and placed on the production line.

Today this lathe is busy working twenty-four hours a day, seven days a week on important war work. BOTWINIK rebuilding made this possible.

BOTWINIK BROTHERS, INC., 373 WELTON STREET **NEW HAVEN, CONN.**

LATHES

No. 324 Adriance Spinning

MILLING MACHINES

2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sunstrand Rigid Mill M.D.

TURRET LATHES

Goss & De Leeuw Chucking, 6"x6½".

DRILLS

No. B16 Natco M.D. (2).
No. B13, Natco, M.D.
4 Spindle Taylor & Fenn M.D.
6' Cincinnati Bickford Radial.

GEAR MACHINERY

6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

MISCELLANEOUS

8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
21'x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
No. 303 Bliss St. Side Gd. M.D.
2" Acme Bolt Threader

WIGGLESWORTH MACHINERY CO.
203 Bent St., Cambridge, Mass.

Your Old Machine Tools

Completely Rebuilt & Modernized for War Production

WRITE • PHONE • WIRE

RIVERSIDE MACHINERY CO., Inc.
133 MULBERRY ST. (WOrth 4-5711) NEW YORK CITY

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40" M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Univ., No. 5 B & S, 20" x 72".
GRINDER, 18" x 30" x 96" Norton Cyl., M.D.
LATHE, Driving Wheel, 78" Bement, Dble. End.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'.
SLOTTER 15" Dill Table Dia. 34".

LANG MACHINERY COMPANY
28th St. & A.V.R.R. Pittsburgh, Pa.

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3d St., Cleveland, Ohio
2832 E. Grand Blvd., Detroit, Mich.

AVAILABLE NOW

54" swing x 22' bed Johnson engine lathe; loose change gears; compound rest; steady rest; nice condition.

6½ and 7" capacity Cold Saws with 20" inserted tooth Saw; single pulley.

14" swing x 8' bed Monarch tool-room lathe; taper attachment; motor drive with motor and switch; chucks; milling attachment.

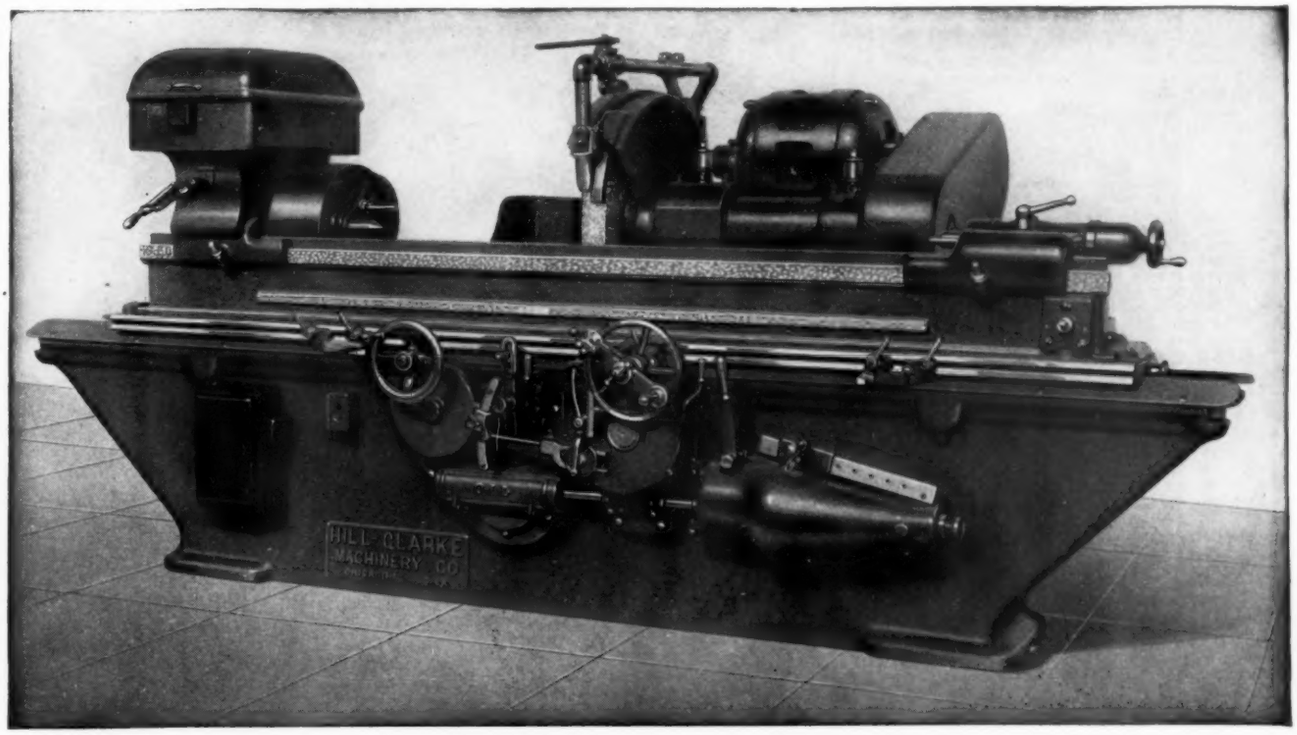
A. R. MARSH MACHINERY CO.
4900 W. 73rd St. Cleveland, Ohio

Announcing Our New Location

6—Gleason Gear Cutters, 11" and 18" machines
52x20' New Haven Lathe
48" Boring Mill
12—25 KVA Spot Welders
48x8 Planer
500# Board Drop Hammer
1000# Steam Hammer
Cleveland Automatics—⅞", 2¼", 2¾", single spindle
Arter Grinder, 6x20, cylindrical

Paul's Motor & Machinery Supply Company
6111 Vermont St. Detroit, Michigan
Tyler 76300-02

Yours for Super Grinding!



HILL-CLARKE MODERNIZED CYLINDRICAL GRINDERS

give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES			
10 x 36	14 x 36	16 x 50	18-30 x 96
10 x 50	14 x 50	16 x 72	

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO

. . IN STOCK

AUTOMATICS
- ¾" Gridley Model F, four spindle
- No. 515 National Acme, four spindle
- No. 52 National Acme, four spindle
- 2⅛" Cleveland Model A, single spindle
- 2½" Cleveland Model A, single spindle

BROACHES
- No. XB10 Oilgear Hydraulic Twin spindle
- 15 Ton Hercules Vertical

DRILLS
- 24" Cincinnati, single spindle, tapping attachment
- No. 17 D Moline Hole Hog, six spindle, No. 5 M. T.
- 4' Prentice Radial
- No. 1½ Foote Burt, 2 spindle
- No. 15½ Foote Burt Fixed Center
- No. 37 Natco Multiple Spindle
- No. 1 Bausch, 8 spindle
- Pratt & Whitney Gun Barrel, 2 spindle, m.d.

GEAR CUTTERS
- No. 3 Brown & Sharpe Automatic
- No. 36 BM Gould & Eberhardt Rougher, three spindle
- No. 6 Fellows Gear Shaper
- 96" Gleason Gear Planer
- 15" Gleason Spiral Bevel Generator
- 18" Gleason Gear Tester
- No. 5A Lees-Bradner Gear Generator
- No. 10 Lees-Bradner Gear Grinder
- 30" Rochester Gear Tooth Rounder

GRINDERS
- No. 2 Cincinnati Centerless
- 10" x 20" Landis Cylindrical, hydraulic
- 8" Heald Rotary Surface
- No. 55 Heald Cylinder
- No. 60 Heald Cylinder
- No. 24—53" Gardner Disc

LATHES
- 14" x 8' Walcott, c.d.
- 16" x 6' Cisco, g.h.
- 16" x 6' LeBlonde, c.d.
- 17" x 8' Sidney, c.d.
- 24" x 12' Walcott Blaisdel, c.d.
- 24" x 12" Walcott, c.d.
- 24" x 14' Reed Prentice, g.h.
- 30" x 13' American, g.h.

TURRET LATHES
- No. 3A Warner & Swasey, g.h.
- 24" Steinle, g.h., 6" hole
- No. 6A Potter & Johnston, g.h.
- 3" x 36" Jones & Lamson, g.h., bar and chucking

MILLS
- No. 1½ Cincinnati Universal, c.d.
- No. 2A Brown & Sharpe Universal, s.p.d.
- No. 12 Brown & Sharpe Plain, c.d.
- No. 4 Cincinnati Vertical, s.p.d.
- No. 5C Becker, Vertical
- 2½ Cleveland Horizontal Boring, s.p.d.
- 4" Bement Niles Horizontal Boring
- 4½" x 12" Pratt & Whitney Thread Mill
- 6" x 48" Pratt & Whitney Thread Mill

MISCELLANEOUS
- Wicaco Oil Groover
- 2" Pratt & Whitney Duplex Spline Mill
- No. 253 Dreis & Krump Press Brake, m.d.
- 2½" Landis Bolt Cutter, with lead screw
- No. 8 Whitney Comb. Punch & Shear

PLANERS AND SHAPERS
- 54"x54"x16' Niles Bement Pond Planer, 4 heads
- 38"x38"x12' Niles Double End Planer, 4 heads
- 16" Gould & Eberhardt Shaper, c.d.
- 20" Ohio Shaper, c.d.
- 24" Cincinnati Shaper, c.d.

SAWS
- 6" x 6" Peerless Universal Shaping, m.d.
- 9" x 9" Peerless Universal Shaping, m.d.
- No. 12 Higby Cold Cut, 16" blade
- 48" Ryerson Friction, m.d.

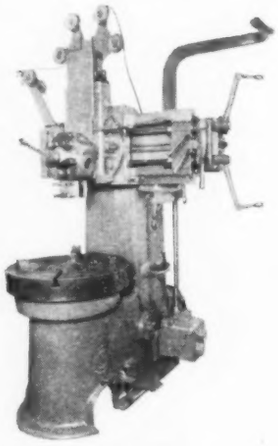
TAPPERS
- No. 20 BG Garvin, m.d.
- ½" Rickert Shafer Radial, m.d.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

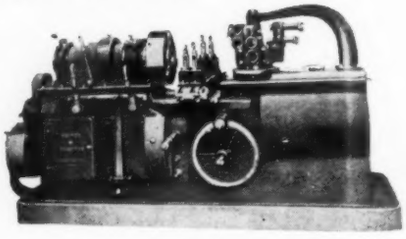
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

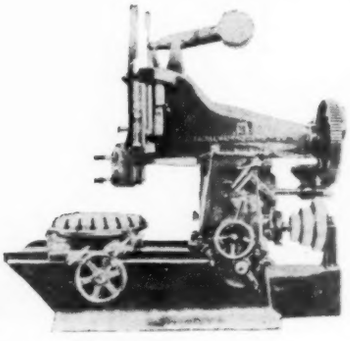
H A L T !



4
REBUILT—12"x72" CINCINNATI
Plain Grinder, 4 motors

GISHOLT VERTICAL BC MILL
34" swing—5 hole turret.
Power rapid traverse





6A POTTER & JOHNSTON Auto. Chucking & Turning machine. Serial, over 18,600.

10" DILL Slotter
24" diameter table
Will cut to center of 54"

Immediate delivery on these unusual and very desirable tools

NO PRIORITY NEEDED

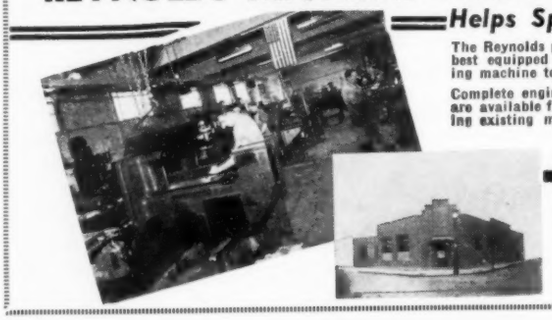
DETAILED INFORMATION ON REQUEST

Frank Toomey Machinery Co.

116 N. Third St. WALNUT 5575 Phila., Pa.

REYNOLDS MACHINE TOOL REBUILDING . . .

Helps Speed War Production



The Reynolds plant is one of the most modern and best equipped plants in Rhode Island for rebuilding machine tools.

Complete engineering and manufacturing facilities are available for modernizing, motorizing and placing existing machine tools in condition for maximum production demands and highest accuracy.

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211 Eddy St.
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Phone: Gaspee 5187

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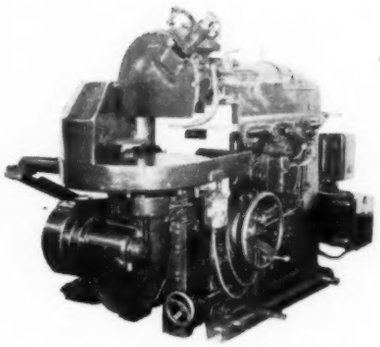
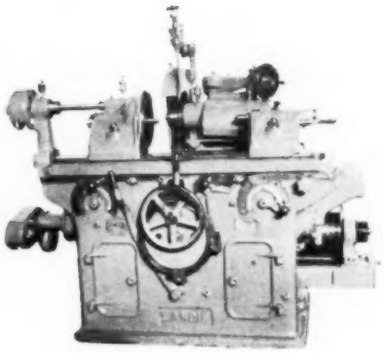
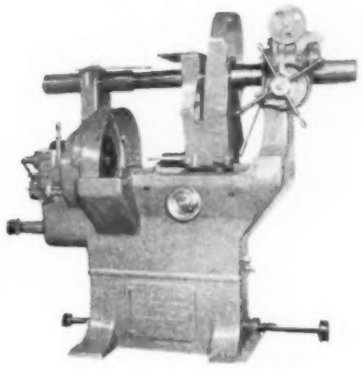
EMERMAN — Chicago offers — GRINDERS



No. 25A Heald Rotary Surface Grinder



10"x24" Landis Plain Grinder



No. 18 Bryant Internal Grinder

SURFACE GRINDERS

1—25-A Heald Rotary Surface Grinder
1—No. 96-30" Gardner Surface Grinder
1—No. 5 Diamond Surface Grinder
1—Osterholm Horiz. Surface Grinder
1—48" Safety Surface Grinder
1—No. 33 Abrasive Vertical Surface Grinder

DISC GRINDERS

1—No. 24-53 Gardner Horiz. Disc Grinder
1—36" Standard Opposed Disc Grinder
1—No. 26 Besly Opposed Disc Grinder
2—No. 6 Besly Opposed Disc Grinders
1—No. 27 Gardner Opposed Disc Grinder
1—No. 84-16" Gardner D.E. Disc Grinder
1—No. 1 Gardner D.E. Disc Grinder
2—No. 2 Gardner D.E. Disc Grinders
2—No. 4 Gardner D.E. Disc Grinders
1—No. 8DA Hisey-Wolf D.E. Disc Grinder
1—6C Gorton S.E. Disc Grinder

CYLINDRICAL GRINDERS

1—10" x 24" Landis Plain Grinder
2—10" x 24" Norton Plain Grinders
1—10" x 36" Landis Plain Grinder (camshafts)
1—10" x 36" Norton Plain Grinder (camshafts)
1—No. 16 Brown & Sharpe Plain Grinder
2—No. 132 Arter Automatic Grinders
1—16" x 32" Landis Type AB Crankpin Grinder
1—16" x 42" Landis Hydraulic Crankpin Grinder
1—Precision Bar & Tube Grinder

MISCELLANEOUS GRINDERS

1—No. 10 Hanchett Saw Grinder
1—No. 3 Milwaukee 2-sp. Cock Grinder
1—156" Knife Grinder
1—Hammett Profile Grinder
1—Danly Feedmatic
2—12-sp. Defiance Valve Grinders

INTERNAL GRINDERS

1—No. 6 Bryant Hole Grinder
1—No. 15 Bryant Hole Grinder
2—No. 18 Bryant Hole Grinders
1—No. 60 Heald Internal Grinder
1—No. 23 Baxter Whitney Internal Grinder

TOOL AND CUTTER GRINDERS

1—Springfield Wet Tool Grinder
3—Ingersoll Cutter Grinders
1—No. M-1 Grand Rapids Tap Grinder
1—Ingersoll Face Mill Grinder
1—Gleason 15" Spiral Cutter Grinder
1—No. 51 Oliver Drill Pointer
2—La Pointe Broach Grinders
1—Webster & Perks D.E. Grinder
1—U. S. Snagging Grinder
1—Type 2 LA Hisey D.E. Grinder
1—No. 3 Mormon D.E. Grinder
1—No. 1 La Salle D.E. Grinder

This fine selection of GRINDERS is offered to you, available for IMMEDIATE DELIVERY. Visit our warehouse and see these and the many other machine tools that we are offering to meet your requirements.

LOUIS E. EMERMAN & CO.

CHICAGO, ILLINOIS

KEEP 'EM RUNNING!

Every machine listed in this column is in our warehouse at press time.

MILLING MACHINES

No. 9 N.B.P. Vertical, 32" rotary table.
No. 10 N.B.P. Vertical, 39" rotary table.
30" x 30" x 10' NEWTON Slab Miller

GEAR CUTTERS

24" G&E Spur, M.D.
36" B&S Spur, M.D.
60" B&S Spur, M.D.
50" G&E Spur and Bevel

THREADING MACHINES

2" B&K Pipe, LANDIS Head
2" B&K Motor Drive with motor
4" B&K LANDIS HEAD and cut-off
4" LANDIS Pipe with cut-off
6" B&K, cut-off, M.D.
10" STANDARD Pipe, S.P.D.
14" E.C.&B. Pipe S.P.D.
¾" GATERMAN Vert. Tapper
4" BAKER Vert. Tapper
16" BAKER Vert. Tapper

PUNCHES AND SHEARS

20" Throat H&J No. 00 ¾" x ⅜"
42" Throat L&A No. 2 1" x 1"
42" Throat H&J No. 2 1" x ⅞"
42" Throat H&J No. 4 1¾" x 1"
54" Throat H&J No. 5 1¾" x 1⅛"
60" Throat L&A No. A 1¾" x 1"
24 Throat L&A Double End ¾" x ¾"
RT 40 SCHULTZ-NAUMAN Beam Shear
6" x 6" x ⅝" Angle Shear
L&A Multiple Punch 6" x 72"
NIAGARA Circle Shear ⅛" x 18"
Washer Press, SOUTHWARK No. 3

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 North Broadway, Albany, N. Y.
N. Y. Office: 149 Broadway

USED MACHINE TOOLS
GUARANTEED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
4 spdl. Henry & Wright
4 spdl. Sigourney
4 spdl. Woodward & Rogers

RADIAL DRILLS
3' Western Heavy Plain

GEAR CUTTERS
No. 60 BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS
(See page 159—special advertisement Hill-Clarke Cylindrical Grinders)
No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating
No. 10 Lees-Bradner Spur Gear Grinder
1½" dia. New Yankee Drill Grinder

LATHES
No. 4 AC LeBlond Auto. Duplex Crankshaft

TAPPERS
No. 4 Gaterman Tapper, 5/16" Cap.

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. CHICAGO

TO MANUFACTURERS HAVING DIRECT CURRENT

Here is a real opportunity to acquire machines already equipped for DC Operation, available immediately:

#5B B & S Plain Milling Machine
#3 Cincinnati Plain Milling Machine
#8 W & S Universal Turret Lathe, 3½" cap.
36"x14' Putnam G.H. Engine Lathe
20"x8' Lodge & Shipley G.H. Engine Lathe
18"x10' Whitcomb Blaisdell G.H. Engine Lathe

Write or Wire for Details

H. H. PELZ MACHINERY CO.
9 South Clinton Street
Chicago, Illinois

FOR SALE

48" CINCINNATI SEMI-AUTOMATIC FACE MILLER; with power quick return; table 57"x12".

DAVIS MILLER ENG. CO. CYLINDER BORING BAR; dia. of bar 10"; capacity 14" to 40" holes.

No. 1 BAUSH MULTIPLE SPINDLE DRILL; arranged for 8 spindles; equ. with 4 spindles; M.T. 2.

No. 23 B. D. WHITNEY CYLINDER GRINDER; motor drive; grinds holes from 3" to 7" dia.

No. 2 LA POINTE BROACHING MACHINE; for keyways up to ⅜" wide; square holes up to 1¼"; stroke 25".

GONNARD BROS.
1426 CENTRAL AV. CINCINNATI, O.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DEWITT TOOL COMPANY
173 Grand St. New York City

500# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
36" G & E Gear Cutter.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24" G & E Shapers
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

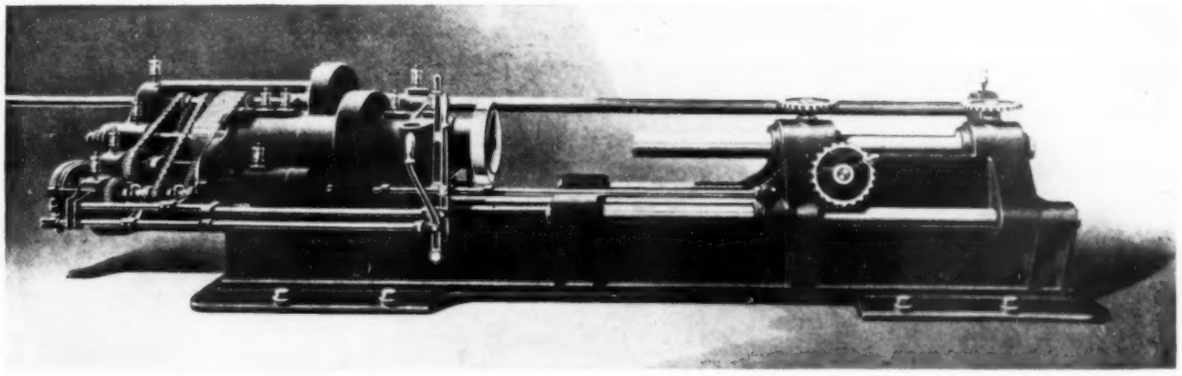
ENGINE LATHE
29" x 20' RAHN-MAYER-CARPENTER S. Q. C.
Mounted on raising blocks to swing 39".
36" diameter faceplate with chuck jaws.
26" diameter faceplate, three steady rests.
24" four-jaw fitted independent chuck.

ALSO MANY OTHER TOOLS

ALEX ZEEVE & COMPANY
2269 Woolworth Building New York, N. Y.

SHELL BORER

Capacity to 10"



#23 AMALGAMATED SHELL BORING MACHINE

Condition like new. Immediate shipment. Complete information on request.

FRANK TOOMEY MACHINERY CO.

116 N. THIRD ST. (Walnut 5575) PHILADELPHIA, PA.

ST. LOUIS' Headquarters
FOR GOOD USED TOOLS, OFFERS:

ROCKFORD 24" S.P.D. Shaper
COLBURN 42" Vert. Boring Mill
MUELLER 4½' Gear Box Drive Radial Drill
PUTNAM 27"x14' Q.C.G. Lathe
PRENTICE 24"x12' M.D. Grd. H.D. Lathe
KEMPSMITH #2 Univ. Miller
NILES 12" Vert. Slotter
INGERSOLL 2—SP. Vert. Miller
B&S 48"x10", #4 Gear Cutter
BROWN & SHARPE #2 Hd. Screw Mach.
GOULD & EBERHARDT Rotary Milling Mach.

Write Us For Any Other Tools You May Want
Let Us Quote On All Machinery Needs

McDONALD MACHINERY CO.
1531-35 N. Broadway St. Louis, Mo.

REYNOLDS
MACHINERY CO.

1—2¼" Gridley Automatic **Screw Machine**
1—#16 Brown & Sharpe **Cylindrical Grinder**, 10"x72"
2—#0 **Manville Header**, D.S.S.D.
1—#00 **Manville Header**, D.S.S.D.
2—#1 **Manville Header**, D.S.S.D.
1—#2 National **Nail Machine**, SSOD
1—#32 Sleeper & Hartley **Nail Machine**
2—#00 Farrel Foundry **Thread Rollers**
1—#2 H.A.P. Haskins **Tapping Machine**

WE BUY ENTIRE PLANTS

GA spee 5187

211 EDDY ST., PROVIDENCE, R. I.

AUTOMATICS, 6" x 6¾" Goss & De Leeuw., #34 New Britain Chucker

GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin, to top of table 18"; 30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 12" x 72" Landis; 12" x 96" Landis; 12" x 120" Landis; 14" x 96" Cincinnati; 24" Bridgeport Disc D.C., M.D.

GEAR CUTTERS—11" & 6" Gleason Bevel Gear Generators (4); 36" G & E Spur and Bevel. 48" & 36" Cinci spur (2), 60" Gould & Eberhardt, spur.

KEYSEATERS—#3 Baker, 26" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M. #1 Davis.

MILLING MACHINES—#3 Lees Bradner Thread Miller; #3 P & W die sinker; #6 Jackson Die Sinker or Vertical Miller; No. 10 NBP vert. 60" diam. table, #4 Cincinnati Vertical, M.D.

PLANERS & SHAPERS—36" x 36" x 10' Flather, 2 hds., M.D.; 26" x 8' Gray; 24" x 6' Powell, 28" & 24" G. & E. Shapers; 16" Cinci. Univ. Shaper.

RADIAL DRILLS—5' Cinci., Bickford Univ.; 6' & 5' N.B.P. Plain; 4' Western Plain.

LATHES—20" x 10' L. & S., T.A.; 21" x 15' LeBlond; 24" x 14' Schumacher Boye, T.A.; 26" x 18' Putnam, T.A.; 64" x 28' New Haven.

ROSENKRANZ MACHINERY CO.
30 Church Street New York, N. Y.

NEW "SEARCHLIGHT" ADVERTISEMENTS

received by November 2nd will appear in the November 12th issue, subject to limitations of space available.

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AMERICAN MACHINIST
330 West 42d St., New York City

1—No. 6 Fellows Gear Shaper, serial No. 4872, belt driven, good condition, immediate delivery.

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road Rochester, N. Y.

FOR SALE
No. 8 AJAX BULLDOZER
with direct motor drive 20 H.P. A.C. and Starter

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave. Chicago, Illinois
37 years' experience
"Anything containing IRON or STEEL"

SPECIAL OFFERINGS

2—400 Ton Capacity Hydraulic Presses, 66" x 42" Cold Platens, 7'—5" Vertical Opening, 5200# Hydraulic Working Pressure, 30" Stroke of Ram.

1—400 Ton Capacity, 8 Opening Hydraulic Press, 52" x 30" Steel Steam Platens, 3" per Opening. Complete with Pump, Motor, Valves, Piping, to Make Completee Self-contained Unit.

Headquarters for Hydraulic Pumps, Presses, Accumulators, etc., in Varying Sizes and Capacities.

INDUSTRIAL EQUIPMENT CO.
856 Broad Street Newark, New Jersey

AIR COMPRESSOR

#10 Ingersoll-Rand Imperial 850 cu.ft. displacement 150 Horse Power Motor

DRILLS

44 Sp. Baush Multiple
4' Fosdick Radial
3 Sp. Henry & Wright

M-G-M PRESENTS

GEAR MACHINES

2—#12 Barber Coleman Single Overarm
#6 Fellows Gear Shaper

LATHES

1" x 18" Pratt & Whitney Automatic
18 x 8 L & S Selective G.H.

MILLS

5C Becker Vertical Billings & Spencer Universal Die Sinker
24" Cinn Automatic
#21 Brown & Sharpe Production S.P.D.

TURRET LATHES

3" x 36" Jones & Lamson

MILLS-GAVAN MACHINERY SALES
3126 GRAND RIVER AVE. • TEL. TE. 1-3148
DETROIT, MICHIGAN

MARDIS MACHINERY

1" Cleveland Automatic Screw Machine
#1 B.S. Miller 4 Heavy Hand Millers.
Lathes 9" to 36" swing.
Hand Screw Machines to 2⅛".

WANTED TOOL MACHINERY

Parkway 0785 . . . . 433 E. Pearl St.
Res. HI 5570 Cincinnati, Ohio

FOR SALE

Used **Dynamometer, Sprague,** 250 volts, type UC20, 50 HP ball bearing, cradle type, Fairbanks beam scale, with control panel complete, with large resistance bank.

ALSO

Olsen Torque Testing Machine with 1 HP motor, capacity up to 5' shafts; and **Olsen Impact Testing Machine,** serial 8145.

HIGHWAY TRAILER COMPANY, Edgerton, Wis.

Colburn 42", 54" Boring Mill 2 hds.
Niles 53" Boring Mill, 2 hds.

CANAL MACHINERY CO.

176 Lafayette Street New York City

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BRADLEY HAS THE BUYS IN ALL TYPES OF MACHINE TOOLS

DRILLS

2 spdl. Leland Gifford
4 spdl. Woodward & Rogers
6 spdl. Allen Drill

GRINDERS

2—#20 Bryant Internal Grinders
New Combination grinder and polisher
Norton double end grinder
#2 Diamond Surface Grinder
#3 Diamond Surface Grinder
New Bradley hydraulic internal grinders

AUTOMATICS

#00 Brown & Sharpe
Model F Gridley 4 spdl.

LATHES

LeBlond Double End 8"
Perkins 20 x 10' LCG
New American bench lathes

MILLS

Garvin #2 Hand Mill
Porter #500 Vertical
#1 Bristol Hand
Gooley & Edlund Briggs type

PRESSES

Screw Cutting Toledo
6 ton Fox Super Flexible
20 Ton General 18" stroke
#4 Bliss 50 Ton
#94 Bliss
Waterbury Farrell 3" stroke
PG5 Ferrecute 70 Ton

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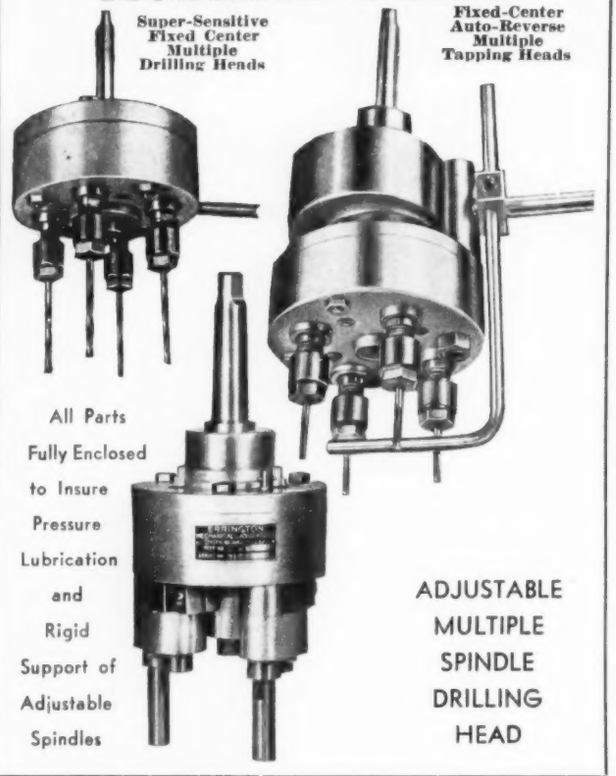

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S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., Watertown, Mass.
Webber Gage Co., Cleveland

BLOCKS, "V"
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Skilsaw, Inc., Chicago

BLUING, Layout
Dykem Co., St. Louis

BOLT & NUT MACHINES
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haskins Co., B. G. Chicago
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V. & O. Press Co, Hudson, N. Y.

BOLTS, Eye & T-Slot
American Chain & Cable Co., Bridgeport, Conn.
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BOLTS & NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.

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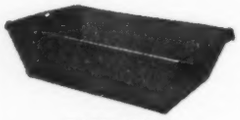

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One-piece, all-welded construction. Hook handle at each end. Will nest perfectly when empty.

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A straight side shop box with rigid handle and hook hole each end. Excellent for shop use where stacking feature is not required.

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STACKING BOXES

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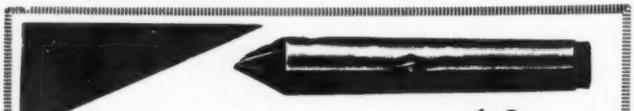
1509 Germantown Ave. — Philadelphia, Pa.



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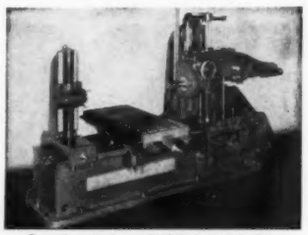

Standard Universal 3"Spindle Machine

UNIVERSAL BORING MACHINE CO.

Hudson, Mass., U. S. A.

WHERE-TO-BUY DIRECTORY

Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
Rhode Island Tool Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

BORING, DRILLING & MILLING MACHINES, Horizontal
Atlantic Machinery Co., N. Y. C.
Arey Drilling Mach. Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bryant Machinery & Engrg Co., Chicago
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Defiance Mach. Wks., Inc., Defiance, Ohio
DeVlieg Machine Co., Ferndale, Mich.
Foote-Burt Co., Cleveland
General Machy. Corp., Hamilton, O.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Ohio Machine Tool Co., Kenton, O.
Sheffield Corp., Dayton, O.
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson, Mass.
Yoder Co., Cleveland

BORING MACHINES, Jig (See JIG-BORING MACHINES)

BORING MACHINES, Precision
Barnes Co., W. F. & John, Rockford, Ill.
Bryant Machinery & Engrg. Co., Chicago
Ex-Cell-O Corp., Detroit
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Heald Machine Co., Worchester, Mass.
Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Sheffield Corp., Dayton, O.
Universal Boring Mach. Co., Hudson, Mass.

BORING MILLS, Vertical
Baush Mach. Tool Co., Springfield, Mass.
Bullard Co., Bridgeport, Conn.
Cincinnati Planer-Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
King Machine Tool Co., Cincinnati
Sellers & Co., Inc., Wm. Philadelphia
Springfield Mach. Tool Co., Springfield, O.

BOXES, Tote
American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BRAKES, Bending, Power
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

BRAKES, Electric
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

BRICK, Furnace (See REFRACTORIES)

BROACHES
American Broach & Machine Co., Ann Arbor, Mich.
Butterfield & Co., Derby Line, Vt.
Colonial Broach Co., Detroit
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
East Shore Mach. Pdts. Co., Cleveland
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Mach. Co., Cincinnati
Colonial Broach Co., Detroit
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Thompson Grinder Co., Springfield, O.

BRONZE, Phosphor (See PHOSPHOR BRONZE)

BUFFERS & POLISHERS
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker-Turner Co., Plainfield, N. J.

BUFFERS & POLISHERS, Hand
Behr-Manning Corp., Troy, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.

BULLDOZERS
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Elmes Eng. Works, Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O
Watson-Stillman Co., Roselle, N. J.

BURNERS, Gas & Oil Furnace
American Gas Furn. Co., Elizabeth, N. J
Hones, Inc., Charles A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

BURNISHERS, Gear
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.

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OHIO, U. S. A.

WHERE-TO-BUY DIRECTORY

Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BURNISHING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
Sheffield Corp., Dayton, O.

BURRING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Hill Acme Co., Cleveland
National Broach & Machine Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

BUSHINGS, Drill
Carboloy Co., Detroit
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Steel (See LOCKERS & SHELVING)

CALIPERS & COMPASSES
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Ansonia, Conn.
Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
Weldon Tool Co., Cleveland

CARBURIZERS (See also BOXES, Heat-Treating & Annealing)
American Gas Furn. Co., Elizabeth, N. J.
Houghton & Co., E. F., Philadelphia
Surface Combustion Corp., Toledo, O.

CARTRIDGE-CASE FINISHING MACHINES
Coulter Mach. Co., Jas., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CASTINGS
American Brake Shoe & Fdry. Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunting Brass & Bronze Co., Toledo
Etna Machine Co., Toledo, O.
Hill Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Johnson Bronze Co., New Castle, Pa.
Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

CEMENT, Belt
Desmond-Stephan Mfg. Co., Urbana, O.
Dixon Crucible Co., Jos., Jersey City, N. J.
Houghton & Co., E. F., Philadelphia

CEMENT, Refractory
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

CENTERING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

CENTERS, Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

CENTRIFUGALS (See PURIFIERS, Oil & Coolant)

CENTRIFUGAL MACHINERY
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

CHAIN, Forged-Steel Link
American Chain & Cable Co., Bridgeport, Conn.
Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

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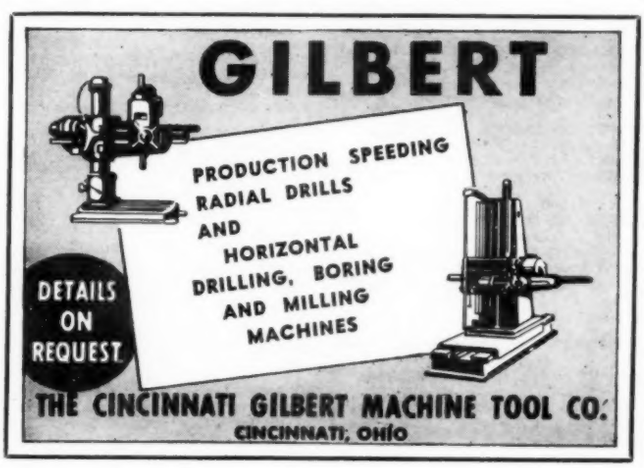

WHERE-TO-BUY DIRECTORY

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

CHECKS, Metal, Time and Tool
Acromark Co., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See TOOLS, Hand)

CHISELS, Chipping, Pneumatic & Electric Hammer
Bethlehem Steel Co., Bethlehem, Pa.
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
Scully-Jones & Co., Chicago

CHUCKING MACHINES (See also LATHES, Automatic & Semi-Automatic)
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Gorton Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

CHUCKS, Air (See CHUCKS, Pneumatic)

CHUCKS, Collet (See Collets)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Ettco Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros. Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Motorized Electric
Cushman Chuck Co., Hartford, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.
Harnischfeger Corp., Milwaukee
Rivett Lathe & Grinder, Inc., Boston

CLAMPS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
North Bros. Mfg. Co., Philadelphia
Williams & Co., J. H., Buffalo, N. Y.

CLEANERS, Metal (See COMPOUNDS, Cleaning)

CLEANING EQUIPMENT (See METAL-CLEANING EQUIPMENT)

CLOTH, Abrasive (See PAPER & CLOTH, Abrasive)

CLUTCHES, Friction
Allis-Chalmers Mfg. Co., Milwaukee
Carlyle Johnson Machine Co., Manchester, Conn.
Dodge Mfg. Corp., Mishawaka, Ind.
Errington Mech. Lab., Stapleton, N. Y.
Foote Bros. Gear & Machine Co., Chicago
Hill Acme Co., Cleveland, O.
Lipe-Rollway Corp., Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Indianapolis

COLLARS, Safety
American Pulley Co., Philadelphia
Carlyle Johnson Machine Co., Manchester, Conn.
Dodge Mfg. Corp., Mishawaka, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLARS, Spacing
Atkins & Co., E. C., Indianapolis
Hill Acme Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Scully-Jones & Co., Chicago
Standard Pressed Steel Co., Jenkintown, Pa.

COLLECTORS, Dust
Blake Co., Edward, Newton Centre, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Covel Mfg. Co., Benton Harbor, Mich.
Torit Mfg. Co., St. Paul, Minn.

COLLETS
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
National Twist Drill & Mach. Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Stark Tool Co., Waltham, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Van Norman Mach. Tool Co., Springfield, Mass.
Warner & Swasey Co., Cleveland

COMPARATORS, Dial
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

COMPARATORS, Gear-Tooth & Screw-Thread
Farrel-Birmingham Co., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

COMPARATORS, Optical
Jones & Lamson Mach. Co., Springfield Vt.
Scherr Co., Inc., Geo., N. Y. C.
Vard, Inc., Pasadena, Calif.

COMPASSES, Metal-Scribing (See CALIPERS & COMPASSES)

COMPOUNDS, Cleaning
Bullard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroitt
Houghton & Co., E. F., Philadelphia
Magnus Chemical Co., Garwood, N. J.
Oakite Products, N. Y. C.
Turco Products, Inc., Los Angeles

COMPOUNDS, Drawing, Metal & Wire
Houghton & Co., E. F., Philadelphia
Sell Oil Co., Inc., N. Y. C.

COMPOUNDS, Grinding & Polishing
Carborundum Co., Niagara Falls, N. Y.
National Broach & Machine Co., Detroit
Norton Co., Worcester, Mass.

COMPOUNDS, Plastic Molding
Bakelite Corp., N. Y. C.
Dow Chemical Co., Midland, Mich.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

COMPOUNDS, Tempering & Case-Hardening
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Strong, Carlisle & Hammond Co., Cleveland
Stuart Oil Co., D. A., Chicago

COMPRESSORS, Air & Gas
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Curtis Pneumatic Machry. Co., St. Louis
General Electric Co., Schenectady, N. Y.
Wright Mfg. Div. of Amer. Chain & Cable Co., York, Pa.

CONSULTANTS
Trundle Engrg. Co., Cleveland

CONTOUR MACHINES
Continental Machines, Inc., Minneapolis
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CONTRACT WORK (See also Index, last page)
Aluminum Co. of America, Pittsburgh
Baldwin Southwark Corp., Philadelphia
Bayard & Co., M. L., Philadelphia
Chapman-Valve Mfg. Co., Boston (Heat-Treating)
Continental Can Co., Inc., N. Y. C.
Eastern Machine Screw Corp., New Haven, Conn.
Elmes Engrg. Wks., Chas. F., Chicago
Ericeson Screw Machine Prod. Inc., Brooklyn, N. Y.
Excello Corp., Detroit (Heat-Treating)
Fenn Mfg. Co., Hartford, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Hartford Special Machy. Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
Carlyle Johnson Machine Co., Manchester, Conn.
Kent-Owens Machine Co., Toledo, O.
Kropp Forge Co., Chicago (Forgings)
Liberty Tool & Gage Wks., Providence, R. I. (Jigs & Fixtures)
Meisel Press Mfg. Co., Boston
National Acme Co., Cleveland
National Twist Drill & Tool Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn. (Screw Machine Products)
Revere Copper & Brass, Inc., N. Y. C. (Forgings)
Rhode Island Tool Co., Providence, R. I. (Drop Forgings; Heat Treating; Screw Machine Products)
Stewart Iron Wks. Co., Inc., Cincinnati
Surface Combustion Corp., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.
Watson-Stillman Co., Roselle, N. J.
Williams & Co., J. H., Buffalo, N. Y.
Woodworth Co., N. A., Ferndale, Mich.

CONTROLLERS, Motor
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland
Square D Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

CONTROLLERS, Pressure & Temperature
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia

CONTROLS, Flexible-Shaft (See SHAFTS, Flexible)

CONTROLS, Furnace
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Mach. Co., Cleveland

CONTROLS, Hydraulic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

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Mathews Conveyor Co., Ellwood City, Pa.
Standard Conveyor Co., N. St. Paul, Minn.

COOLANT SYSTEMS, Portable
Gray Mills Co., Chicago

COOLANTS, Cutting, Drilling & Grinding
Carborundum Co., Niagara Falls, N. Y.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.

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Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., Ltd., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

COUNTERBORES
Barnes Drill Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
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Cleveland Twist Drill Co., Cleveland
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

COUNTERSHAFTS
American Tool Works Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Mach. Co., Philadelphia
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
LeBlond Mach. Tool Co., R. K., Cincinnati
Rivett Lathe & Grinder, Inc., Boston
Stow Mfg. Co., Binghamton, N. Y.
Warner & Swasey Co., Cleveland

COUNTERSINKS (See **DRILLS, Twist**)

COUNTERS, Revolution & Stroke
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

COUPLINGS, Hose
Cleveland Pneu. Tool Co., Cleveland
Schrader's Son, A., Brooklyn, N. Y.

COUPLINGS, Shaft, Flexible
Allis-Chalmers Mfg. Co., Milwaukee
Delta Mfg. Co., Milwaukee
Earle Gear & Mach. Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Foote Bros. Gear & Mach. Co., Chicago
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

COUPLINGS, Shaft, Non-Flexible
Dodge Mfg. Corp., Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
Hill Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Jib
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Portable
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Overhead Traveling
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machry. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUSHIONS, Die
V. & O. Press Co., Hudson, N. Y.

CUTTERS, Angle
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Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
McCrosky Tool Co., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago

CUTTERS, Die-Sinking
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Gorton Machine Co., Geo., Racine, Wis.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Formed
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Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

CUTTERS, Gear
Adams Co., Dubuque, Iowa
Bantam Bearings Corp., S. Bend, Ind.
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Scherr Co., Geo., N. Y. C.
Standard Tool Co., Cleveland
Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Waltham Mach. Wks., Waltham, Mass.

CUTTERS, Hand Pipe (See **STOCKS, DIES & CUTTERS, Pipe**)

CUTTERS, Keyseater
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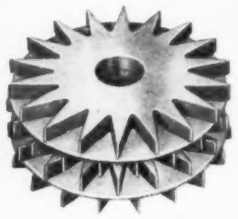

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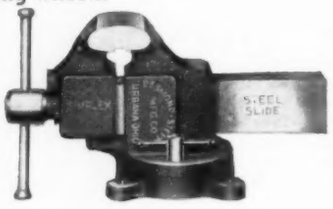

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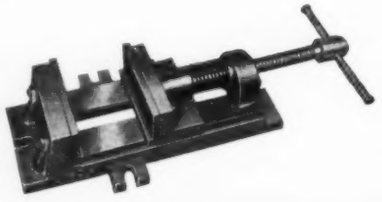

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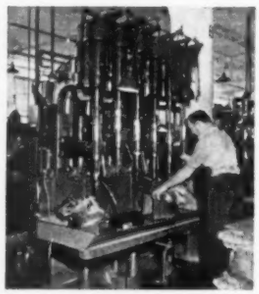

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National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
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Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gorton Mach. Co., George, Racine, Wis.
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Haynes Stellite Co., N. Y. C.
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McCrosky Tool Corp., Meadville, Pa.
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Michigan Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
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National Twist Drill & Tool Co., Detroit
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Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H. Buffalo, N. Y.

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Campbell Div., Andrew C., American Chain & Cable Co., Bridgeport, Conn.
deSanno & Sons, Inc., A. P., Philadelphia
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Racine Tool & Mach. Co., Racine, Wis.

CYLINDERS, Air (See TANKS & CYLINDERS, Air)

CYLINDERS, Hydraulic (See PRESSES, Hydraulic)

DEALERS, Machinery (See Searchlight Section)

DEGREASERS (See Metal Cleaning Equipment)

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L-W Chuck Co., Toledo, O.
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Walker Co., O. S., Worcester, Mass.

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Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Smit & Sons, Inc., J. K., N. Y. C.

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Reed-Prentice Corp., Worcester, Mass.

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Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap and Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland

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Dykem Co., St. Louis
Lufkin Rule Co., Saginaw, Mich.
Producto Mach. Co., Bridgeport, Conn.
Starrett Co., L. S., Athol, Mass.

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Continental Machines, Inc., Minneapolis
Gorton Machine Co., Geo., Racine, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
Illinois Tool Works, Chicago
Johnson Tool Co., E. Providence, R. I.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.

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Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

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Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
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Reed-Prentice Corp., Worcester, Mass.

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Cunningham Co., M. E., Pittsburgh
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

DIES, Screw-Cutting, Adjustable
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
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Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
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Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
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Card Mfg. Co., S. W., Mansfield, Mass.
Consolidated Machine Tool Corp., Rochester, N. Y.
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Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn.
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass.

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See **WHEELS, Grinding & Polishing**)

DISKS, Circular Cutting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See **CALIPERS & COMPASSES**)

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Cincinnati Lathe & Tool Co., Cincinnati
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LeBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
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Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Metal Carbides Corp., Youngstown, O.
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSERS, Radius & Angle
Auto Ordnance Corp., Bridgeport, Conn.
J & S Tool Co., E. Orange, N. J.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark, N. J.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See **STEEL, Tool**)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
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Fosdick Machine Tool Co., Cincinnati
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National Auto. Tool Co., Richmond, Ind.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLS, Bench
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Cincinnati Bickford Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
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Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

DRILLS, Breast (See **TOOLS, Hand**)

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Firth-Sterling Steel Co., McKeesport, Pa.
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Morse Twist Drill and Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRILLS, Column-Type
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
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Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Dalzen Tool & Mfg. Co., Detroit
Davis & Thompson Co., Milwaukee
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Sibley Machine Co., South Bend, Ind.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Core
Carboloy Co., Inc., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Morse Twist Drill & Machine Co., New Bedford, Mass.
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Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See **DRILLS, Twist & Flat**)

DRILLS, Hand (See **TOOLS, Hand**)

DRILLS, Horizontal
Avey Drilling Machine Co., Cincinnati
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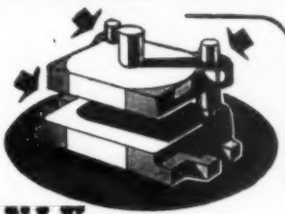

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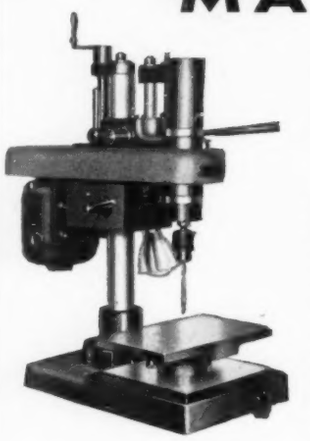

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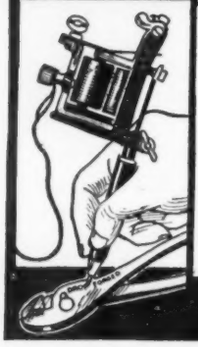

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Snyder Tool & Engrg. Co., Detroit

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DRILLS, Portable Pneumatic (See **TOOLS, Portable Pneumatic**)

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Standard Tool Co., Cleveland

FANS, Man-Cooler (See BLOWERS)

FEEDS, Die (See FEEDS, Press)

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Sundstrand Mach. Tool Co., Rockford, Ill.
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Scherr Co., Inc., Geo., N. Y. C.
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Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See **GAGES, Plug & Ring**)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See **ENAMELING & GALVANIZING MACHINES**)

GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Colonial Broach Co., Detroit
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield Mass.
Philadelphia Gear Works, Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati

WHERE-TO-BUY DIRECTORY

Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland

GEARS, Master
Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GEARS, Non-Metallic
Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland
Taylor Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GRAINS, Abrasive
Bay State Abrasive Prod. Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O.

GRINDERS, Abrasive-Belt
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Mattison Machine Works, Rockford, Ill.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Bench & Pedestal
Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Machinery & Engrg. Co., Chicago
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Queen City Machine Tool Co., Cincinnati
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Walls Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Tool & Mach. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.

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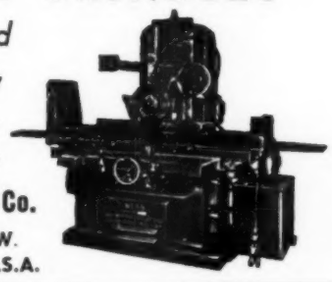

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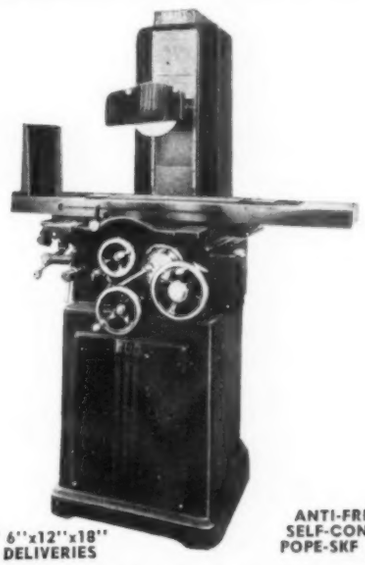

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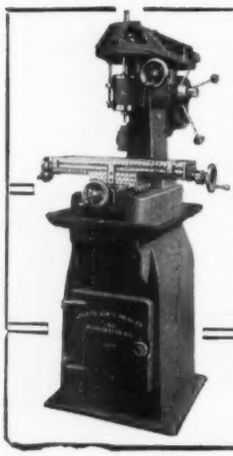

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Moore Spec. Tool Co., Bridgeport, Conn.

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Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See ATTACHMENTS, Lathe)

GRINDERS, Portable Electric (See also TOOLS, Portable Electric)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Swing-Frame
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cello-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See CONTRACT WORK)

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneu. Tool Co., Cleveland

HAMMERS, Power
General Machinery Corp., Hamilton, O.
Sellers & Co., Wm., Philadelphia

HAMMERS, Softfaced
Greene, Tweed & Co., N. Y. C.
Johnson Tool Co., Inc., E. Providence, R. I.

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.

HANDLES, File
Disston & Sons, Inc., Henry, Philadelphia
Nicholson File Co., Providence, R. I.
Parker-Kalon Corp., N. Y. C.

HANGERS, Shaft
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
SKF Industries, Inc., Philadelphia

HARDENING MACHINES, Flame
Air Reduction, N. Y. C.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

HEADERS, Rivet
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.

HEADS, Boring
Bullard Co., Bridgeport, Conn.
Carboloy Co., Inc., Detroit
Criterion Mach. Wks., Beverly Hills, Cal.
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Calif.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

HEADS, Dividing
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Hartford Special Machry. Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
L-W Chuck Co., Toledo, O.
Scherr Co., Geo., N. Y. C.

HEADS, Drilling
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
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Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

HEADS, Grinding
Ex-Cell-O Corp., Detroit
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.

HEADS, Milling
Cincinnati Milling Mach. Co., Cincinnati
Kempsmith Machine Co., Milwaukee

HEADS, Slotting
Experimental Tool & Die Co., Detroit

HEADS, Tapping
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.

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Bradford Mach. Tool Co., Cincinnati
Cross Gear & Machine Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Etco Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.

HEATERS, Rivet
American Gas Furn. Co., Elizabeth, N. J.
General Electric Co., Schenectady, N. Y.

HEATERS, Unit
Buffalo Forge Co., Buffalo, N. Y.
Surface Combustion Corp., Toledo, O.
Wiedemann Machine Co., Philadelphia

HELMETS & SHIELDS, Welding
Air Reduction, N. Y. C.
American Optical Co., Southbridge, Mass.
Harnischfeger Corp., Milwaukee
Hobart Bros. Co.,, Troy, O.
Lincoln Electric Co., Cleveland

HOBBERS, Gear
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Machy. Co., Cleveland
Hall Planetary Co., Philadelphia
Lees-Bradner Co., Cleveland
Scherr Co., Geo., N. Y. C.

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Mach. Co., Hartford, Conn.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

HOISTS, Chain
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Ford Chain Block Div., Am. Chain & Cable Co., Philadelphia
Wright Mfg. Div. of Am. Chain Cable Co., York, Pa.

HOISTS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Harnischfeger Corp., Milwaukee
Philadelphia Gear Works, Philadelphia
Wright Mfg. Div., Amer. Chain & Cable Co., York, Pa.

HOISTS, Pneumatic
Curtis Pneu. Machy. Co., St. Louis
Tomkins-Johnson Co., Jackson, Mich.

HOLDERS, Tool
Armstrong Bros. Tool Co., Chicago
Auto Ordnance Corp., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

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Dayton Rubber Mfg. Co., Dayton, O.
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INDEXING FIXTURES (See FIXTURES, Indexing)

INDICATORS, Dial (See GAGES, Dial)

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Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

INDICATORS, Temperature
Brown Instrument Co., Philadelphia

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Wilson Mechanical Inst. Co., N. Y. C.

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Jones & Lamson Mach. Co., Springfield, Vt.
Vard, Inc., Pasadena, Calif.

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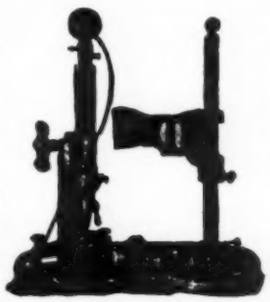

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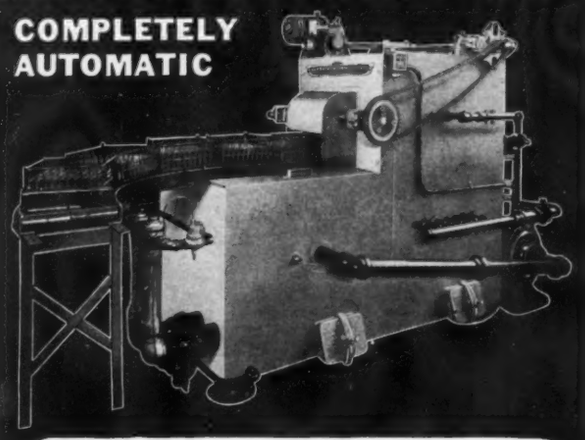

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Sunnen Products Co., St. Louis

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LATHES, Shell
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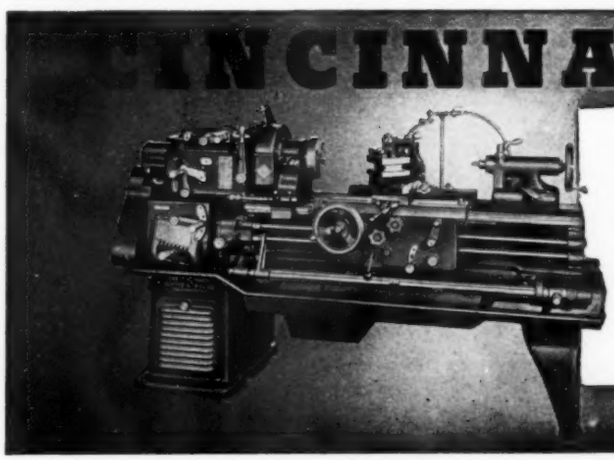

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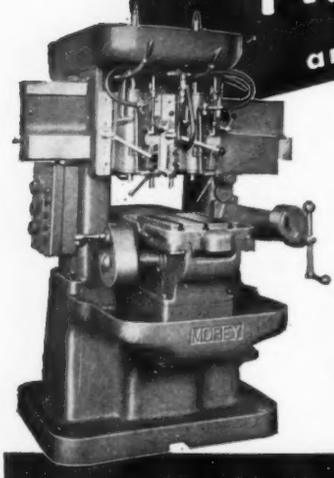

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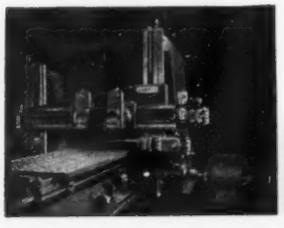

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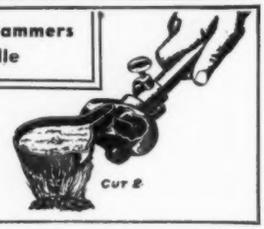

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Plan-O-Mill Corp., Royal Oak, Mich.

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Gorton Machine Co., Geo., Racine, Wis.
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Kearney & Trecker Corp., Milwaukee
Kempsmith Mfg. Co., Milwaukee
Knight Machinery Co., W. B., St. Louis
Linley Bros. Co., Bridgeport, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, O.
Sommer & Adams Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

MOLDING MACHINES, Plastic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLDS, Lead Hammer
Johnson Tool Co., Inc., E. Providence, R. I.

MOLYBDENUM
Molybdenum Corp. of America, Pittsburgh

MOTORS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Century Electric Co., St. Louis
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y
Harnischfeger Corp., Milwaukee
Howell Elec. Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Wesche Electric Co., B. A., Cincinnati
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

MOTORS, Geared (See **MOTORS, Electric**)

MOTORS, Hydraulic (see also **PUMPS, Hydraulic**)
Racine Tool & Mach. Co., Racine, Wis
Sundstrand Mach. Tool Co., Rockford, Ill
Vickers, Inc., Detroit

NAMEPLATES
Acromark Co., Elizabeth, N. J.
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., Hartford Conn.

NIBBLERS
Campbell, Andrew C., Div. Amer. Chain & Cable Co., Bridgeport, Conn.
Mitts & Merrill, Saginaw, Mich.
Savage Tool Co., Savage, Minn.

NOZZLES, Blast-Cleaning
Norton Company, Worcester, Mass.
Schrader's Sons, A., N. Y. C.

NUMBERING MACHINES (See **MARKING MACHINES**)

NUT-BLANKING MACHINES
Cleveland Automatic Mach. Co., Cleveland
National Acme Co., Cleveland
Potter & Johnston Machine Co., Pawtucket, R. I.

OIL STONES (See **STONES, Sharpening**)

OILERS, Automatic (See **LUBRICATING SYSTEMS**)

OILS, Cutting
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia

WHERE-TO-BUY DIRECTORY

Racine Tool & Mach. Co., Racine, Wis
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.
White & Bagley Co., Worcester, Mass.

OILS & GREASES (See **LUBRICANTS**)

OILS, Hydraulic
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Shell Oil Co. Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

OILS, Quenching & Tempering
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Oil Co., N. Y. C.

PACKING, Hydraulic
Elmes Engrg. Wks., Chas. F., Chicago
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F., Philadelphia
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

PAINTS, Varnishes, etc.
Devoe & Raynolds Co., Inc., N. Y. C.
Dixon Crucible Co., Jos., Jersey City, N. J.

PAPER & CLOTH, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

PENCILS
Dixon Crucible Co., Jos., Jersey City, N. J.

PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo
Johnson Bronze Co., New Castle, Pa.

PICKLING MACHINES (See **METAL-CLEANING EQUIPMENT**)

PINS, Dowel & Taper
Allen Mfg. Co., Hartford, Conn.
American Steel & Wire Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.
Danly Machine Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

PIPE CUTTING & THREADING MACHINES
Armstrong Bros. Tool Co., Chicago
Bardons & Oliver, Inc., Cleveland
Cleveland Automatic Mach. Co., Cleveland
Hill Acme Co., Cleveland
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Inc., Geo., N. Y. C.
Warner & Swasey Co., Cleveland

PLANERS
Cincinnati Planer Co., Cincinnati
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Liberty Planers, Inc., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Rockford Mach. Tool Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia

PLANERS, Plate
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Sellers & Co., Wm., Philadelphia

PLATES, Angle
Brown & Sharpe Mfg. Co., Providence, R. I.
Lombard Governor Corp., Ashland, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATES, Surface
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Mfg. Co., Milwaukee
Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool & Engrg. Wks., Inc., Bucyrus, Ohio
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATFORMS, SKID (See **TRUCKS, Hand Lift**)

PLATING, Brass, Chromium, Copper
Chromium Corp. of Amer., N. Y. C.
Industrial Chromium Corp., Holyoke, Mass.

PLATING, Spot
Industrial Chromium Corp., Holyoke, Mass.

POTENTIOMETERS
Brown Instrument Co., Philadelphia
General Electric Co., Schenectady, N. Y.

POTS, Melting
Farrell-Birmingham Co., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Hones, Inc., Chas. A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

PRESSES, Arbor
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Fameo Machine Co., Racine, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Lucas Machine Tool Co., Cleveland
Nicholson & Co., W. H. Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.
Sheldon Machine Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.

PRESSES, Crank (See **PRESSES, Power**)

PRESSES, Foot
Etna Machine Co., Toledo, O.
Fameo Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H., Bridgeport, Conn.
V. & O. Press Co., Hudson, N. Y.

PRESSES, Forging
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Cleveland Punch & Shear Works Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Hydraulic
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
General Machinery Corp., Hamilton, O.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Lempco Products, Inc., Bedford, O.
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wright Mfg. Div. Amer. Chain Co. Inc., Bridgeport, Conn.

PRESSES, Power (Punch)
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Bpffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Clearing Mach Co., Chicago
Cleveland Crane & Engrg. Co., Steelweld Machry. Div., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., Cleveland.
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hendey Machine Co., Torrington, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kent-Owens Machine Co., Toledo, O.
Lempco Products, Inc., Bedford, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H. Bridgeport, Conn.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
V. & O. Press, Hudson, N. Y.
Wiedemann Machine Co., Philadelphia
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Producto Machine Co., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Straightening
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PRESSES, Turret Punch
Federal Press Co., Elkhart, Ind.
Wiedemann Machine Co., Philadelphia

PROFILERS (See **MILLERS, Vertical**)

PROJECTORS, Contour
Jones & Lamson Machine Co., Springfield, Vt.
Portman Machine Tool Co., Mt. Vernon, N. Y.
Scherr Co., Geo., N. Y. C.

PROTRACTORS, Optical
Scherr Co., Geo., N. Y. C.

PULLERS, Gear & Wheel
Owatonna Tool Co., Owatonna, Minn.

PULLEYS, Iron, Steel & Wood
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Carlyle Johnson Machine Co., Manchester, Conn.
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland
Reeves Pulley Co., Columbus, Ind.

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•Fewer Parts
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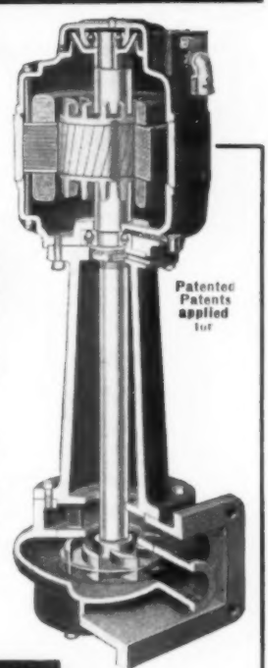
GUSHER
COOLANT PUMPS



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1809 READING ROAD, CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

WHERE-TO-BUY DIRECTORY

PULLEYS, V-Belt (See **SHEAVES, V-Belt**)

PUMPS, Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Engrg. & Mfg. Co., Detroit
Ruthman Machry. Co., Cincinnati
Tomkins-Johnson Co., Jackson, Mich.

PUMPS, Hydraulic
Allis-Chalmers Mfg. Co., Milwaukee
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass
Racine Tool & Machine Co, Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

PUMPS, Lubricant and Coolant
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Forge Co., Buffalo, N. Y.
Gray Mills Co., Chicago
Pioneer Engrg. & Mfg. Co., Detroit
Rivett Lathe & Grinder, Inc., Boston
Ruthman Machinery Co., Cincinnati
Sundstrand Mach. Tool Co., Rockford, Ill.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit

PUNCHES, Center & Hand (See **TOOLS, Hand**)

PURIFIERS, Oil & Coolant
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

PYROMETERS, Indicating & Recording
Brown Instrument Co., Philadelphia

QUENCHERS
American Gas Furn. Co., Elizabeth, N. J.
Farrel-Birmingham Co., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.

RACKS, Gear (See **GEARS, Cut**)

RASPS (See **FILES & RASPS**)

RATCHETS (See **GEARS, Cut**)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, Pipe
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schultz & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

RECORDERS, Speed (See **INDICATORS, Speed**)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
James Co., D. O., Chicago
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Stahl Gear & Machine Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

REELS, Strip-Stock & Wire
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N.Y.
General Machinery Corp., Hamilton, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. B., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

RULES & TRIANGLES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.
Van Keuren Co., Watertown, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Porter-Cable Mach. Co., Syracuse, N. Y.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADES, Circular Metal-Cutting
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg., Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADES, Hack & Band (See **BLADES, Hack & Band-Saw**)

SAWS, Band, Metal-Cutting (Machines)
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Capewell Mfg. Co., Hartford, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Earle Gear Machine Co., Philadelphia
Moteh & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn.
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.

WHERE-TO-BUY DIRECTORY

Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See DIES, Screw-Cutting, Adjustable)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs. Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

SETTERS, Nut (See TOOLS, Portable)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

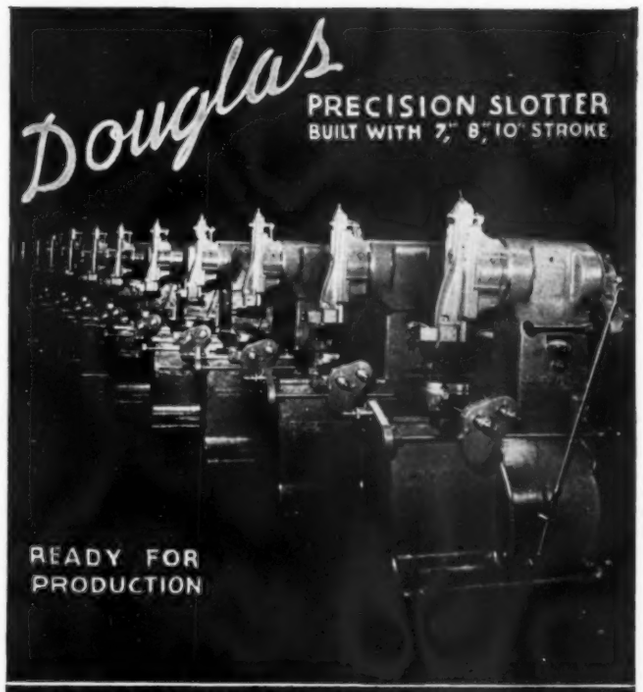
SHEET-METAL WORKING MACHINERY (See BRAKES, Bending Press; DIES, Sheet-Metal; Forming Machines; NIBBLERS; PRESSES; REELS, Stripstock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal)

SHELL-MAKING Machinery
Bullard Co., Bridgeport, Conn.
Colman & Sons, Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See TRUCKS, Hand)

SLEEVES & SOCKETS, Drill
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield Mass.



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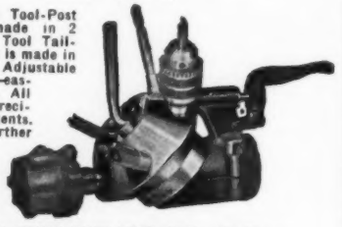

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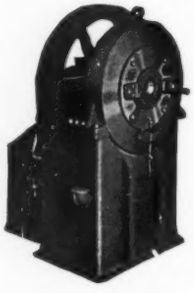

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Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago

SPROCKETS (See **GEARS, Cut**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

STEEL-MILL PRODUCTS
Allegheny-Ludlum Steel Corp., Pittsburgh (Steel and stainless steel sheets, plates, tubes, wire and strip)
American Steel & Wire Co., Cleveland (Cold-finished bars, wire and wire products)
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass.

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

STRAIGHTEDGES (See **DIE-MAKERS' SUPPLIES**)

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

SUB-PRESSES & DIES (See **Dies, Subpress**)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

SURFACE-BROACHING MACHINES (See **BROACHING MACHINES**)

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SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Allen-Bradley Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See **INDICATORS, Speed**)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St. Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See **PINS, Dowel & Taper**)

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Ettco Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See **DIES, Adjustable**)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Wood & Spencer Co., Cleveland

TESTING EQUIPMENT, Tension & Compression
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Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

THREADING MACHINES, Die-Head
Brown & Sharpe Mfg. Co., Providence, R. I.
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

THREADING MACHINES, Roll
Brown & Sharpe Mfg. Co., Providence, R. I.
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See **HOLDERS, Tool**)

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Boring
Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass.
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vaseoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co. Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vaseoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Crafts Co., Arthur A., Boston
Desmond-Stephen Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Norton Company, Worcester, Mass.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

TOOLS, Hand
Allen Mfg. Co., Hartford, Conn.
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Atkins & Co., F. C., Indianapolis
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Capewell Mfg. Co., Hartford, Conn.
Carboloy Co., Detroit
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Dumore Co., Racine, Wis.
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Onsrud Machine Works, Inc., Chicago
Rotor Tool Co., Cleveland
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TOOLS, Stellite
Haynes Stellite Co., N. Y. C.

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Air Reduction, N. Y. C.

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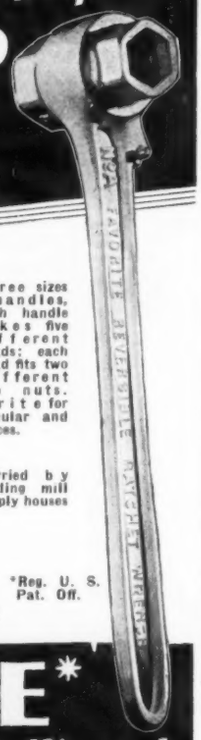

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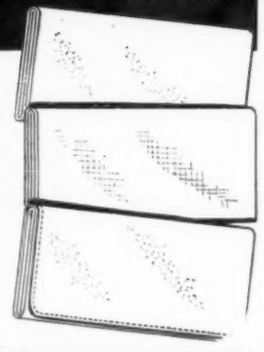

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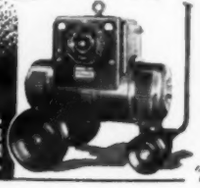

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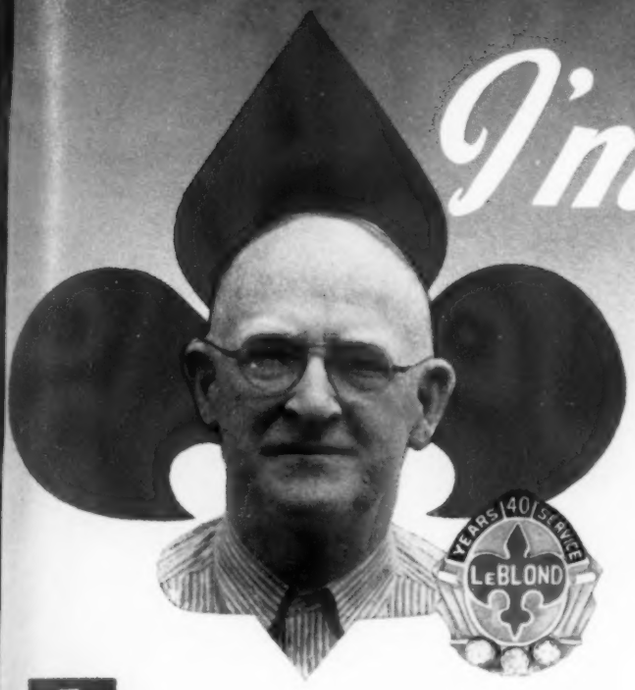
I'm Tellin' You...

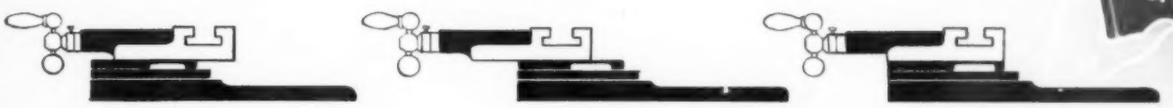


No. 4 in a series of tips on "Keeping 'em Turning"

by ***George Whitehouse****, 41 years at LeBlond's*

Lots of new lathe hands figure that rough turning is a kind of hacking process that doesn't call for much brain work. It's probably true that roughing isn't as much of a trick as finishing, but there are some important do's and don'ts. Here's some dope that you will want to remember.

1 POSITION OF COMPOUND REST FOR ROUGH CUTTING



This is wrong. Slide overhangs too far to right. Might break in middle of tee slot.

This is wrong, too. Slide overhangs to left. Also could break in middle of tee slot.

This is right. When making heavy cuts, top slide should be flush with bottom slide so all metal is in compression.

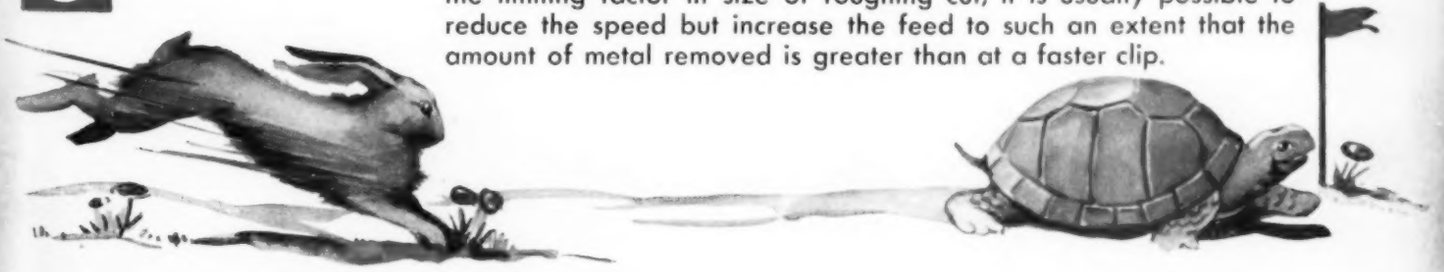
2 CUTTING SPEEDS

KIND OF MATERIAL	CUTTING SPEED Ft. per Min.	DEPTH OF CUT Inch.	RATE OF FEED Per Rev.
CAST IRON	210	3/8	0.062
SEMI-STEEL	280	1/8	0.012
TOOL STEEL	140	1/2	0.020
BRONZE	425	3/16	0.024
BRASS	458	3/32	0.108
ALUMINUM ALLOY	570	1/8	0.031

When using carbide type tools, these figures are as good as any for a general guide. The rigidity of the machine and tool support, interrupted cuts, etc., will make experimentation and adjustments desirable.

3 SLOW DOWN AND FINISH SOONER . . . .

There is a tendency for many lathe operators to work their machine far below top efficiency because they fail to take a deep enough bite. Where tool failure is the limiting factor in size of roughing cut, it is usually possible to reduce the speed but increase the feed to such an extent that the amount of metal removed is greater than at a faster clip.



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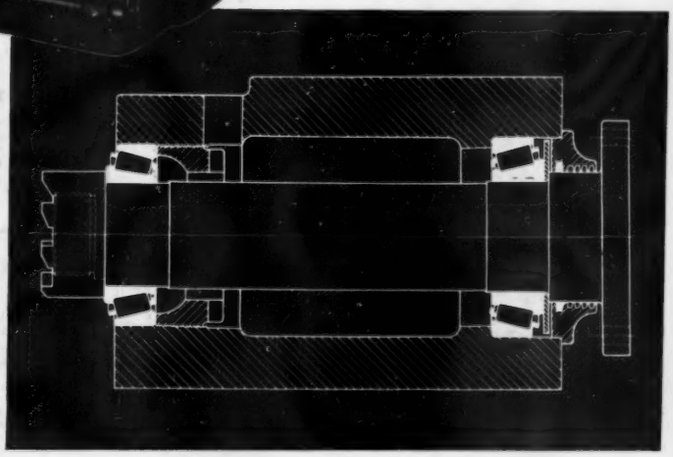

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